

Chemical Engineering Education

FROM its inception the American Institute of Chemical Engineers has taken a lively interest in chemical engineering education and for 17 years has had a continuous succession of committees on that subject. It was perceived in the beginning that if chemical engineering was to gain recognition commensurate with its potential service to industry, the foundation must be laid in educational courses with a definite objective, manned and equipped to turn out a definite product.

IT WAS a happy omen that in this activity the teacher and the industrialist co-operated harmoniously, each contributing his opinion and experience to the organization of appropriate courses. Out of the years of effort came first, about three years ago, a definite formulation of the scope of chemical engineering as a separate branch of engineering, and more recently an approved list of schools teaching chemical engineering according to standards acceptable to the Institute. The list appears on another page in this issue.

IN UNDERTAKING to put its stamp of approval on certain schools the Institute has taken a bold step paralleled only by earlier similar action by the American Medical Association and the American Bar Association. It should result in raising the standard of chemical engineering education in the United States. As a pioneer movement in this branch of learning the action of the Institute may at first be misunderstood in some quarters and misinterpreted in others, though no serious misapprehension is ex-

pected. On its face the committee report means only what it says—that these schools are prepared to teach chemical engineering according to acceptable standards. Inferences and conclusions drawn therefrom may be unwarranted and wide of the mark.

IT WOULD be unfair, for example, to assume that schools not on the present list are wholly without the pale, or that their graduates may not become good chemical engineers. Mere labels will not determine the product. Graduates from approved schools will continue to fall short of the mark of their high calling, and conversely good engineers will develop among graduates of schools not yet on the list. Potentiality will continue to reside in the man. The most the school can do is to equip him with an approved kit of tools in the form of fundamental knowledge. Wise industrialists will not make the mistake of assuming that competent men will come only from the schools mentioned.

IT IS to be expected, however, that the Institute's action will stimulate schools listing chemical engineering in their catalogs to bring their courses into line with accepted standards. For some this will not entail much revision, but for many it must involve a new conception of chemical engineering and a corresponding revolution in their courses and methods of teaching. As these changes are made the Institute's list will expand until a sharper line of demarcation will exist between approved and unapproved schools.

Why Some Plants Don't Like Conveyors

THE RECENT extensive adoption of mechanical handling equipment in the chemical engineering industries has been one of the most hopeful and interesting of developments. We have been surprised, however, to encounter here and there, a plant that has tried modern conveying machinery and decided to go back to former methods.

This anomalous situation was encountered just often enough to make it seem necessary to go to the root of the matter and find out why these particular plants had no use for equipment that was highly successful in competing plants. So a study was made of the situation and it soon became apparent just where the trouble lay. Those plants which found mechanical handling equipment of no advantage had installed the equipment without a sufficient engineering study of their needs. They had either purchased it on their own initiative just as they would office desks and chairs, or they had gone but little further and had made their installation solely on the recommendation of equipment salesmen.

This, unquestionably, was the reason for dissatisfaction. For handling equipment is so closely interrelated with each step of a manufacturing process that in making a handling installation the whole plant and each operation in it should be subjected to the most searching study and engineering analysis. Such a study demands the services of a skilled engineer, one who thoroughly understands the application of all the various types of handling equipment available and, in addition, has such a broad understanding of the chemical engineering industries that he is able to fit the handling equipment properly to the process.

This means, then, that the plant executive should not rely solely upon his own staff nor that of the mechanical handling equipment manufacturer in specifying a handling installation for his plant. What should be done is to turn the design and specification of handling installations over to a qualified, experienced consulting engineer. This procedure will cost more initially, but the increased utility of the handling system thus installed will soon make up this extra cost when compared to the results obtained from a system specified otherwise, which may only realize halfway savings and, in some cases, may be worse than useless.

Chemistry Bridges a Gap Between Viticulture and Metallurgy

THE FUNCTION of chemistry as the keystone of an industrial arch is illustrated by a comparatively recent development in the metallurgy of copper, whereby the efficiency of the flotation process has been considerably improved by the use of potassium xanthate. Credit for the original discovery goes to the technical staff of the Minerals Separation company, the result of which was the evolution and perfection of manufacturing methods by the Great Western Electrochemical Co. of Pittsburg, Calif., which now supplies about 97 per cent of the requirements of the industry, the sale price being regulated by arrangement with Minerals Separation—an indication of efficient business service toward those operating under its patents.

The success of the new reagent has been immediate and complete, and large savings are being effected in

consequence of its adoption by all the important copper producing companies using the flotation process. The development points a moral as to the scope of the chemical engineer in relieving one industry of its surplus raw material and providing another with a compound that is essential to efficient operation. The California raisin industry was raised out of the slough of despond by research and commercial initiative that resulted in the utilization of its excess, second-grade products for the manufacture of alcohol, which is used in large amount for the manufacture of the new metallurgical reagent, potassium xanthate.

To an unobservant individual, it may seem that the unexpected is always happening; but as a matter of fact the discovery of the peculiar properties of xanthate was the direct result of exhaustive research with a specific end in view. Its cheap production, using raw materials of local manufacture, was made possible by the progressive policy of continued expansion in new fields that is characteristic of chemical initiative. The incident, which has all the characteristics of an industrial development of note, is indicative of the unlimited scope in the utilization of basic chemical products.

The Lesson Taught by Michael Faraday

SUCH occasions as the recent centenary of Faraday's discovery of benzene serve a more significant purpose than the incidental calling forth from the layman of a belated recognition of his great indebtedness to science. Desirable as this may be the principal benefit is ours, for it is only through an intimate knowledge that one obtains the true perspective of scientific achievement. The tremendous influence of the discovery of the simple liquid which Faraday described as "bicarburet of hydrogen" to the members of the Royal Society on June 16, 1825, can only be measured in terms of human progress, for it lies at the base of a branch of chemistry that contributes many of the essentials of man's existence.

Faraday's devotion to unremunerative work in the fundamentals of science is an inspiring philosophy of research, stimulating alike to the scientific worker and to the industrialist. The realization that commercial progress is impossible without fundamental knowledge is an object lesson for the capitalist who would put research on the profit-and-loss basis of immediate gain. Faraday's work was an investment that yielded its greatest return many generations after it was begun. The element of speculation, responsible for the financing of much of present-day research, was not the guiding motive of Faraday's study. Rather there was the impelling desire to piece together a foundation of indispensable knowledge on which those who followed might construct the framework of industrial development.

That Faraday's name is better known to the electrical profession than to ours does not detract from his achievements as a chemist. To have discovered the phenomena of electromagnetic induction that have made possible the modern dynamo and have given us the means of directing and controlling the great forces of physical energy, is but inspiring proof that to him science was not an arbitrarily divided field. Like Sir Humphry Davy, the master for whom he worked, Faraday saw no barrier between chemical and electrical

phenomena and it was logical, therefore, that he should have been the one to discover the laws of electrochemical decomposition that underlie so much of our electrochemical industry.

Faraday was working in a period of great activity, of constantly changing perspective in chemistry. Dalton, Gay-Lussac, Berzelius and Avogadro were some of the contemporaries contributing to this atmosphere of incentive. His opportunity was great, and yet who can say that the subsequent progress of science has in reality lessened the opportunity for discovery? The great lesson that Faraday taught, and perhaps his greatest achievement, was the inspiration to push across the borders of existing knowledge in order to establish the fundamentals essential to the continued progress of civilization.

Foreign Competition in Engineering Education

THERE is no embargo on engineering brains nor can a protective tariff wall be erected against foreign-trained technologists willing to come to this country to work for almost nothing in our plants and laboratories. This means that our colleges, in order to turn out a competitive products, must make certain that their production methods are most efficient. It is good business, as well, for them to know what their competitors are doing. The information given at the recent meeting of the Society for the Promotion of Engineering Education by Director W. E. Wickenden, may not have been calculated to stir up educational rivalry, but it certainly offers food for some constructive thinking on the part of both industry and college.

During six months of preliminary survey in Great Britain, France, Belgium, Italy, Switzerland and Germany, Director Wickenden has recorded some striking impressions. Of most interest from our viewpoint is the situation in Germany where there has been a tremendous expansion in higher technical education. Mr. Wickenden estimates that today three technical men are being trained for every one that can be absorbed by industrial Germany. The logical conclusion is that the surplus will be exported as a part of the general economic penetration. Young American engineers and chemists can look forward, therefore, to keen competition, for it is for the lower rungs of the ladder that the foreigner—even though experienced—makes his bid.

In the principal Prussian universities during a period in which medicine, dentistry and some of the other professions have shown marked decreases in enrollment, chemistry attracted 81 per cent more students in 1924 than in 1914. The study of physics increased by 39 per cent. It is of further significance that where the total enrollment in all universities and cultural colleges fell off by one quarter during this decade, the enrollment in the technical schools almost exactly doubled. In 1914 less than one-sixth of all students in Germany were in the technical schools, but in 1924 this branch of education claimed 31 per cent of the total.

Chemical engineering, according to Mr. Wickenden's tabulations of the enrollment of representative German schools, increased from 1,000 to 1,340 students—a gain of 34 per cent. True, in some of our own institutions chemical engineering instruction has shown even more marked advances, yet the comparison is scarcely a fair one, for it must be recalled that in 1914 Germany occu-

pied a position of pre-eminence in this field. To have advanced this by a third during the past ten years shows that there has been no tendency to rest on the laurels of former accomplishments.

In Great Britain, where engineering is a newer division of education, experience and actual attainments are made to count for more in a man's training. This is brought about, directly or indirectly, by the part-time schools for employees, the higher development of apprentice training and, lastly, by the system of recognition and award practised by the engineering societies and institutions.

In both France and Belgium high theoretical emphasis is characteristic of the educational scheme and there has been no broad program for the expansion of technical and engineering study. In Italy, on the other hand, the schools like the industry of that country have been affected by the materialistic influence of the Fascisti government. They are crowded and unless a phenomenal industrial expansion occurs in the near future, there is likely to be an overproduction of engineers. The Swiss situation is not essentially different from that of Germany, although it is reported that limited funds have materially handicapped the expansion of the physical facilities of the famous polytechnic school at Zurich.

It is apparent that our foreign friends have accorded engineering education an important place in their programs for economic rehabilitation. This recognition would be encouraging to all concerned were it not for the fact that overproduction of engineers like any other commodity is likely to react unfavorably on market values. It remains for our own universities and colleges to make certain that they turn out a superior product—creative technologists of a sort that cannot only compete with but actually excel their foreign-trained rivals.

Progress in the Annealing of Glass

ELECTRICITY again comes to the front as providing means for the exact control of temperature in a heating process, with the added advantage of absence of contamination with the products of combustion. Glassware is now being annealed at the San Francisco plant of the Illinois Pacific Glass Co. in a lehr in which electric heating elements have replaced the oil burners used in customary practice. The apparatus is of the continuous type, operating in similar fashion to a tunnel kiln in so far as mechanical movement is concerned, the glassware being delivered by hand from the blower alongside to a special conveyor, the top of which forms the floor of the lehr. The new units, the result of experimentation, research and observation extending over several years, are 55 ft. long, 25 ft. of which is devoted to heating, the remainder to annealing and cooling.

Precise temperature control has been demonstrated as essential to successful annealing, and this is achieved within narrow limits by the use of make-and-break potentiometer instruments, thereby insuring automaticity in operation and freedom from the uncertainties of the personal element. From the technical point of view the new development has proved highly satisfactory, and it is interesting to note that the cost of heating by electricity is such that economic success has also been achieved. Moreover, efficient annealing is now

possible with a considerable saving of time as compared with the old method.

Actual commercial result, however, is the deciding factor from the industrial standpoint. In this connection there is no doubt that the ability to control temperature at each stage of the process with scientific accuracy permits the production of sounder ware and reduces the percentage of "seconds." The absolute cleanliness of ware so annealed is a significant advantage. We noted recently the satisfaction with which electrically annealed bottles were being used by a manufacturer of "rubbing" alcohol, where crystal clarity of container and absence of contamination are advantages of distinct commercial value.

Significant developments in electrical heating in recent years have demonstrated that in many instances it is advisable to ignore the assumed cost of power until research has demonstrated that the close temperature control possible and the ability to conserve heat are advantages that make for ultimate economy. Where contamination in any form is undesirable—for the enameling of iron and for the annealing of glassware, for instance—electricity seems likely to play an increasingly important part as a heating medium.

Babel at Dayton

THE approach to the Scopes trial at Dayton, Tennessee, was marked by a not unexpected confusion of tongues, and the trial itself will undoubtedly see the introduction of a vast amount of irrelevant matter. No one seems worse confounded or more likely to confuse the issue than the eminent counsel for the prosecution. Mr. Bryan to the contrary notwithstanding, Christianity is not at stake, science is not in conflict with religion and there is no need for validating the Bible by an amendment to the constitution. The question is a legal one—whether the Tennessee statute contravenes the federal constitution. The outcome will neither establish nor destroy the theory of evolution, nor will it prevent the enlightened search for truth throughout the world. The law of gravitation will continue to function, the tides will ebb and flow as usual, and the value of π will remain undisturbed. Let the heathen rage and the people imagine a vain thing. Science has no enemy save the ignorant.

Foreign Causes and American Effects

OUR interest in foreign affairs, which can be so definitely measured in terms of international investments, is indirectly exemplified in recent developments that find their reflection in certain of our industries. The connection between Florida phosphates and the Rifian revolt may seem far fetched and yet it has had a dollars-and-cents significance to American producers. As the phosphate deposits were opened by the French in Northern Africa, Tunisian phosphate became a formidable competitor of Florida rock in foreign markets. But when Abd-el-Krim took his tribes on the war path, mining ceased in the Moroccan mines and shortly there was a corresponding increase in the export demand for American phosphate. Present indication is that boom times in Florida are not going to be confined solely to Miami real estate.

Another development, the significance of which is

yet to be determined, may be seen in the newly formed Société des Engrais Azotes et Composes whose present capital of 76,000,000 francs is held by the Société des Phosphates Tunisiens of Paris, and the Norsk Hydro-Elektrisk Kvaelfstofaktieselskab of Oslo. Here, indeed, is a formidable combination since the control of such basic factors as phosphate rock, synthetic nitrogen and hydro-electric power has in it the potentialities of intensive competition for the American fertilizer manufacturer.

Fallacies About Chemical Warfare

WHEN the international Conference on Limitation of Armament was held in Washington in the Fall of 1921 it adopted a resolution prohibiting the use in war of poisonous gases and analogous liquids. Mystery surrounded this action because it was known that a sub-committee of experts had unanimously adopted and offered a report of different tenor which, however, was sidetracked and suppressed. For three and a half years the text of this report has been concealed from the public but has now come to light.

Written by an international committee headed by Edgar F. Smith and General Amos A. Fries representing the United States, the report says that "after careful study of the subject of chemical warfare . . . any convention for regulating chemical warfare should take into account" certain considerations which were then outlined. The committee was unable to see "how to base a limitation on the use of poisonous gases on their physical, chemical or physiological properties." It was thoroughly recognized that it would be impossible to prohibit or supervise research with respect to such gases because many of them are extensively used in peaceful industrial pursuits. Chlorine, bromine, phosgene, chloropicrin and hydrocyanic acid gas, used in the World War, are commodities of the chemical industry; and it would be possible to restrict production of such gases only by international regulation of chemical industry and commerce. Such regulation was and is obviously out of the question. As long as any nation maintains an organic chemical industry it will have a potential chemical warfare arsenal. It was further recognized that the probable resort to chemical warfare by an unscrupulous enemy "would be so serious that no country dare accept the risk of being found unprepared to meet it."

The lapse of over 3 years has offered no new testimony to modify the opinion expressed in *Chem. & Met.*, January 11, 1922, that the suppressed report was more sensible, logical and practical than the one adopted, and the failure of the signatory powers to ratify the action of the conference lends color to the belief that the sentiment of the moment did not long persist.

Nor are we favorably impressed with the activities of Representative Burton at Geneva in a conference called to find means of regulating international traffic in arms. Mr. Burton persuaded this conference to adopt an equally impractical resolution "to prohibit the export . . . of any such asphyxiating poisonous or other gases and analogous liquids intended or designed for use in connection with operations of war." The practical difficulties of such a prohibition will be obvious to anyone familiar with industrial uses of poisonous chemicals and their flow in international trade and commerce. The action is regrettable because it will put

a new barrier across the path of our Chemical Warfare Service which is already handicapped in its legitimate activities. Appropriations for its support, already too meager, may be further curtailed. It is understood that the War Department has been informed that its requests for appropriations for the next fiscal year must be reduced by \$30,000,000; and in view of events in Geneva it is possible that a disproportionate amount of the reduction may be sought from the Chemical Warfare Service.

Education in these technical matters proceeds slowly. Popular sentiment or personal predilection still determines in too large a measure national and international actions. What Representative Burton needed at Geneva was what the Washington conference had and ignored—technical advice.

Chemistry to the Rescue of Art

IN A BROCHURE recently published by the Metropolitan Museum of Art on the Restoration of Ancient Bronzes and Other Alloys, the director discloses some of the curious problems encountered in the preservation of museum specimens and says that "eternal vigilance is the price at which a curator keeps his collection in condition." A casual visitor to a museum is quite unfamiliar with the constant fight that must be waged against the elements to protect and preserve paper, fabric and metal from deterioration, if not from actual destruction. The reader will at once recall the extreme care exercised on opening the tombs of Egyptian Pharaohs to prevent disintegration of many of the precious works of art that had been entombed for hundreds of years. But few of us are familiar with the fact that in modern museums "many objects bring with them the germ of deterioration" and that "one 'diseased' specimen in a show-case may, and frequently does, infect others."

Chemists have previously been called upon to devise ways and means for the preservation of valuable papers and fabrics, but not until recently have their services been sought to prevent the corrosion of metallic works of art. In this connection Professor Colin G. Fink of Columbia University, assisted by Charles H. Eldridge, has made a significant contribution as a result of which ancient bronzes that have become encrusted with products of corrosion through long burial in the earth are salvaged and restored by an electrolytic process of cathodic reduction. The success of the method is indicated in the statement of the director of the museum that "we are now well on the way to salvage brilliantly thousands of bronzes which otherwise might have been ruined by crude attempts at 'cleaning' or discarded altogether as worthless."

A Start in the Right Direction

LATELY we have had occasion to call the fertilizer industry to task for its indifferent attitude toward research as well as the faltering activities of its trade associations. Only two months ago we pointed out in these columns the golden opportunity for progress that was presented by the consolidation and reorganization of the National Fertilizer Association. It is gratifying, therefore, to read in the present report of our Washington correspondent of the splendid start which

the industry has made in the direction of constructive work.

The new association under the direction of Charles J. Brand, its newly appointed executive secretary, has already launched a comprehensive program that promises to solve many of the urgent problems that confront the fertilizer manufacturer. Research on raw materials, if properly directed and followed through, should lead to the ultimate development of a complete industry—independent of the direction and control of outside sources. Eventually it should mean cheaper and better fertilizers. The co-operative work with the state and federal agencies and the university fellowships for soil improvement study should prove more effective than propaganda in bringing the industry back into the good graces of the public it serves. The inauguration of an adequate statistical service and the encouragement of co-operative buying and of better methods of cost accounting will stimulate the industrial revival that has long been needed.

The industry is to be congratulated both on the program it has outlined for itself and the executive it has selected to carry its plans to fruition. A commendable start has been made and it is to be hoped that subsequent progress will justify us in our belief that the industry has awakened to its opportunities and is on its way to better times.

American Investments Determine Our Interest in Foreign Affairs

THOSE who are inclined to wonder whether the United States has any direct and tangible interest in foreign affairs may be enlightened by an analysis of the growth of our international investments made by the National Industrial Conference Board. In 1924 United States private capital was invested abroad to the amount of over \$9,000,000,000, of which 20 per cent was invested in Europe and 44 per cent in Latin American countries. Of the European investment of private capital, \$1,500,000,000, or four-fifths of our European commitment, was loaned to governments, not counting loans made by the United States Government to European governments. This is significant as indicating our large direct interest in European political conditions.

Of our total foreign investments of \$9,000,000,000 fifty-eight per cent has gone into private ventures of an industrial, business or financial character, as well as investments in real property. Forty-two per cent represents loans of governments. The Conference Board points out the great transformation in the world's financial history represented by the change in the century from 1820 to 1920. In the earlier period Europe was lending the struggling United States a bare million dollars a year, while a century later the United States loaned the world nearly a billion and a half dollars in 12 months. From the beginning of the United States as a nation until 1914 capital flowed almost entirely from Europe to America, but this movement came practically to an end with the beginning of the war. Thereafter the tables were turned and in 1920 our annual investments of private capital abroad were thirty times what they were in the pre-war period. With new approaches constantly being made to United States citizens for foreign loans all doubt should vanish as to our personal concern in the progress and welfare of foreign nations.



Making Quebracho Extract In Argentina

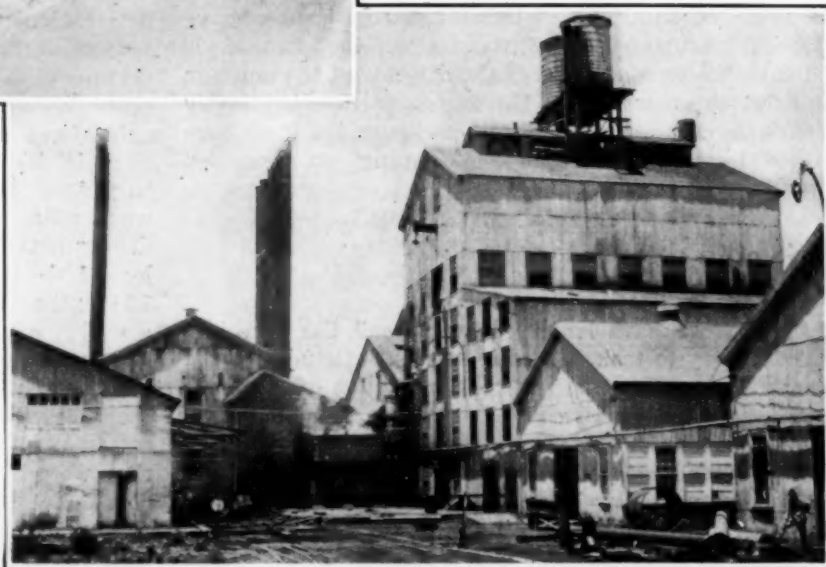


TOP, RIGHT—Hauling quebracho heartwood logs by bullock cart from the forest of the Territory of The Chaco, Argentina.

BOTTOM — A quebracho extract factory now in operation at Tartagal, Sante Fe, Argentina.

TOP, LEFT — A single quebracho tree. These trees sometimes grow in dense forests and in other sections in open stands of 4 or 5 to the acre.

CENTER — Wharf showing cars loaded with quebracho heartwood logs on narrow-gage railroad, awaiting loading into steamers.



Manufacture of Quebracho Extract

Description of the Methods Used for Making the Liquid Extract at the Brooklyn Plant of The Tannin Corporation Together With a Brief Survey of the Industry

By R. O. Phillips

Chief Chemist, The Tannin Corporation, New York, N. Y.

QUEBRACHO forms approximately one-third of all the vegetable tannins used in the production of leather in the United States and Canada. Tanners rely upon it as one of their principal raw materials. All over the world quebracho is looked upon as one of the best of tannins for giving desirable qualities to leather, and more quebracho extract is now produced than any other single vegetable tannin. This remarkable growth, due to the desirable qualities of the material, has all taken place since the discovery of this tannin in the early 1870s.

Originally, the quebracho industry consisted only of the exportation of logs from Argentina for the manufacture of the extract abroad; but in 1896 manufacture of extract on the South American continent commenced. In the following year Messrs. Hartneck & Renner of Hamburg, Germany, built a factory at Calchaquí in the heart of the quebracho forests of the province of Sante Fe, Argentina.

From this small beginning, the industry has grown to large size. Its growth is shown by the following table, which takes no account of the shipments from Paraguay, now approximating 40,000 metric tons of extract and a few logs annually.

(In 1924 the world's production of quebracho extract, in Argentina and Paraguay, and extract made "direct from the imported quebracho logs" in Europe and the United States, amounted to approximately 350,000 metric tons.)

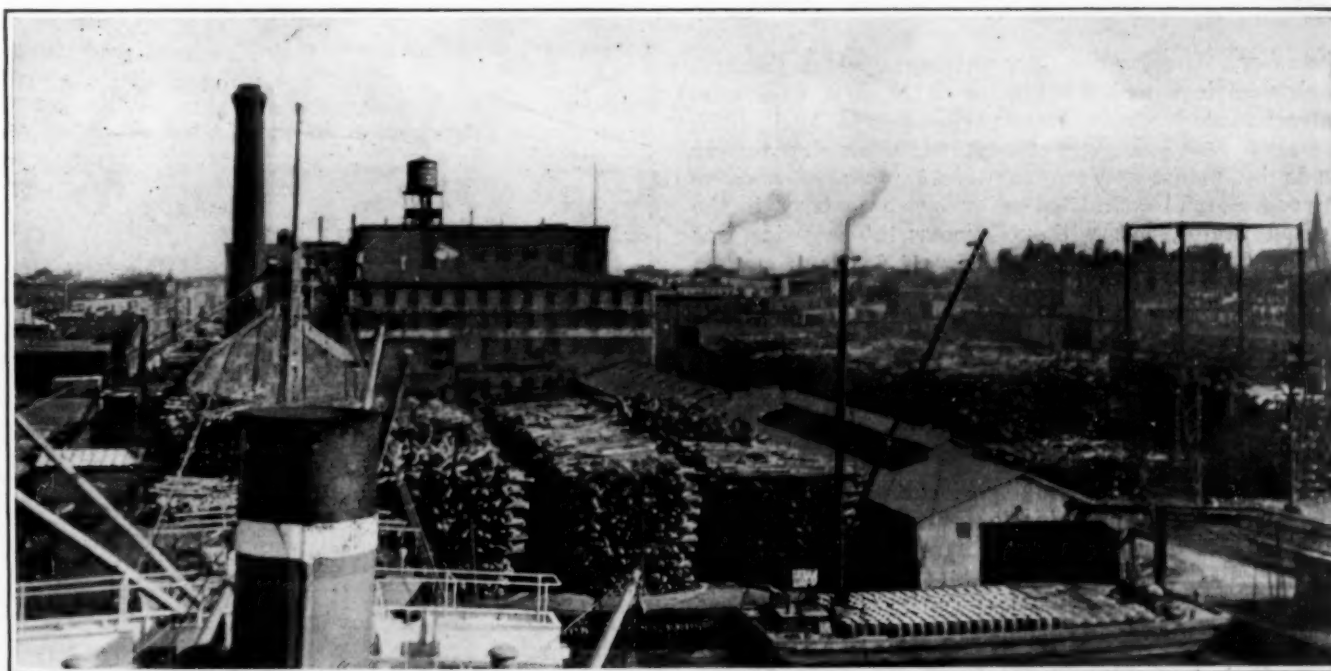
EXPORTS OF QUEBRACHO LOGS AND EXTRACT FROM ARGENTINA

Year	1892-1923	
	(In metric tons of 2,204.6 lb.)	
	Logs	Extract
1892	29,700	.....
1893	49,400	.....
1894	54,300	.....
1895-96	115,369	646
1896-97	114,627	1,092
1897-98	184,800	1,197
1898-99	146,601	2,037
1901	198,920	4,310
1906	230,100	30,839
1911	438,219	68,431
1912	279,342	74,910
1913	383,964	79,684
1914	291,942	80,153
1915	209,679	100,213
1916	101,711	120,010
1917	108,945	100,904
1918	8,046	124,710
1919	51,264	172,568
1920	56,582	122,857
1921	30,857	120,160
1922	124,822	167,845
1923	113,639	208,586

In the following pages there will be given a picture of the industry and a brief description of the manufacture of quebracho extract at the Brooklyn, N. Y., factory of The Tannin Corporation.

HISTORY OF QUEBRACHO EXTRACT MANUFACTURE

In 1798, 127 years ago, a man named William Partridge hitched a horse to a small windlass-grinder on the outskirts of New York City, now West 10th Street, and commenced the manufacture of dyewoods. He was the pioneer in the dyewood and tanning extract industry of the United States. Almost a full century after Partridge started the dyewood business, his distant



Birds-eye View of the Brooklyn Plant of The Tannin Corporation

In this view the general size of the plant and log storage can be seen. Note the barge load of barrels of quebracho extract in the foreground.



Unloading Quebracho Logs at the Brooklyn Pier
Note the cars of the industrial railway, specially designed for carrying this type of load.

successors, The Tannin Corporation, imported the first quebracho logs and manufactured the first quebracho extract made in this country. That was in April, 1897.

For a few years previous to 1897 attempts were made by manufacturers in Germany and France to introduce small quantities of quebracho extract in the United States, but without success. The price was high and the extract was so different in its properties from the tanning extracts with which the American leather manufacturer was familiar, that little quebracho was used in this country prior to 1897.

That quebracho wood was a source of tanning extract was discovered about 1872 by a German tanner in Buenos Aires, who observed that the water near a certain sawmill where quebracho railroad ties were being cut, was very red and had characteristic tannin properties. Experiment in his tannery proved the realization of his hopes and he became the first quebracho tanner. Between 1875 and 1890 quebracho was used in Europe for tanning purposes, principally by "dusting" the hides with the ground wood. It was not until after 1890 that the extract from the wood became popular in Europe.

Northern Argentina and Paraguay are the only regions of the world where quebracho occurs in suffi-

cient quantities for commercial exploitation. Practically all of the world's supply of this wood is obtained in the National Territories of The Chaco and Formosa and the Province of Sante Fe in Argentina and in southern Paraguay. Three types of quebracho are found in this region, but it is only the true quebracho (*quebrachia lorentzii* of the family *Anacardiaceae*), commonly known in Argentina as *quebracho chaqueño*, that is used for tanning extract manufacture. Only the heartwood of the trees is used in the tanning extract factories. The outside whitewood, or sapwood, since it contains little tannin, is taken off with axes and discarded in the forests where the trees are felled.

Quebracho is a name of Portuguese derivation meaning "ax breaker." The wood is one of the hardest and densest woods known, having a specific gravity of 1.40. For this reason it is impossible to raft the logs on rivers, as is done in most lumbering operations. The handling and transporting of these cast-iron-like logs is one of the most difficult problems of the industry.

Quebracho trees are of very slow growth. Those large enough to be used for tannin extraction purposes run all the way from 100 to 1,000 years in age. Consequently, reforestation has not been seriously attempted. Where conditions are favorable, the *quebracho chaqueño* reaches a height of 75 ft. with a trunk diameter of 3 to 4 ft. Average heartwood logs, as used in extract factories, are 10 to 18 ft. in length, 1 to 2 ft. in diameter and run 2 to 3 logs to the metric ton.

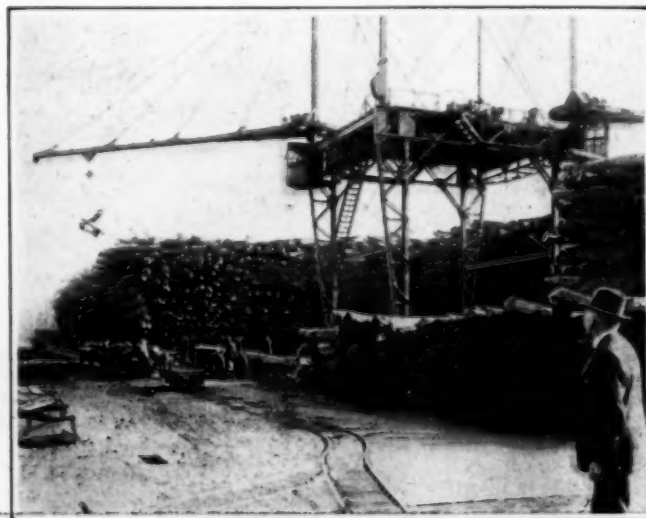
The logs, after having been cut and cleaned of bark and sapwood, are hauled by bullock-cart to the narrow-gauge log railways that extend into the forests. By these railways the logs move to the river ports. Here they are loaded on ocean-going steamers of 6,000 to 7,000 tons log-cargo capacity (at either Sante Fe or Buenos Aires).

An average analysis of quebracho heartwood is:

Tannins	20.40	per cent
Non-tannins	2.31	" "
Insolubles	1.83	" "
Non-extractives	57.19	" "
Water	18.27	" "

Total 100.00 per cent

Quebracho extract used in the United States is of



Storing the Quebracho Logs
After weighing, the logs, still on the cars, are hauled to the crane shown in this picture, which stacks them in "cribs."

2 classes: (1) Liquid extract made from the imported logs and known as "direct from the wood" extract; (2) extract made in Argentina or Paraguay and imported in solid form, which is known as ordinary solid quebracho extract or clarified solid quebracho extract. Following is an average analysis of the two types of solid quebracho extract:

Ordinary Solid Quebracho Extract

Tannins	64.20	per cent
Non-tannins	7.90	" "
Insolubles	7.50	" "
Water	20.40	" "

Total 100.00 per cent

Crown Clarified Quebracho Extract

Tannins	65.65	per cent
Non-tannins	13.40	" "
Insolubles	0.15	" "
Water	20.80	" "

Total 100.00 per cent

MAKING "DIRECT FROM THE WOOD" EXTRACT

In its Brooklyn factory, The Tannin Corporation produces only the "direct from the wood" class of tanning extracts. On account of the superior quality of this extract, due to the careful supervision and advanced methods of the process of manufacture, the leather tanned with this extract is of superior grade.

The cargo of logs, on arriving at the Brooklyn plant from the River Plate, Argentina, is unloaded from the steamship to the small cars of a narrow-gauge railroad and transported on them to the storage yard or direct to the factory, as the case may be. Electric yard cranes of 5 ton capacity are used for piling the logs in "cribs." A cargo of 7,000 tons of logs is unloaded in 10 to 12 days. The total yearly consumption of logs at this plant is nearly 50,000 tons.

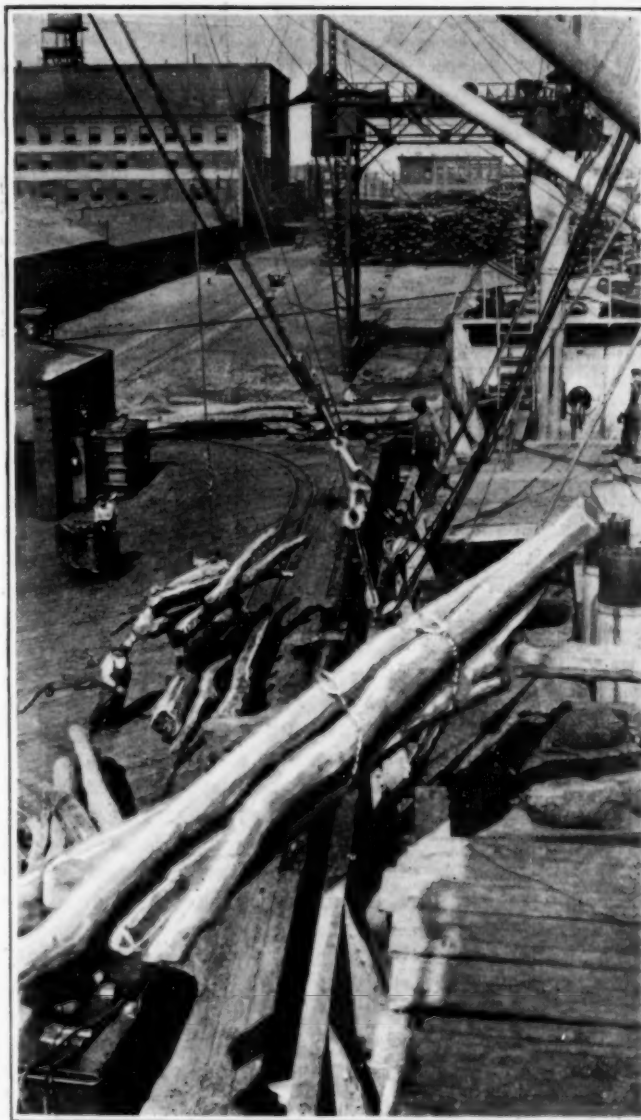
As the logs arrive at the plant they are weighed and then lifted by electric hoists from the cars and fed into an inclined trough fitted with a ram which forces them into the chippers.

The chipping of the wood into chips of a uniform



Close-up of Quebracho Logs

This view gives a good idea of the size and appearance of the quebracho wood used for making extract.



View from Pier Looking Toward Factory

The cars, when loaded with quebracho logs are towed by the storage battery tractors to the scale, shown in the left center, where they are weighed.

fineness, preparatory to the extraction of the tanning extract is the first step in the manufacturing process. The chippers consist of 20-ft. diameter cast-steel disks, upon one face of which are fastened 6 removable knives. These disks each weigh about 18 tons and consume about 200 hp. at full load, with a capacity of 14 tons each of wood chips per hour when operated at full output.

EXTRACTING THE TANNIN

After chipping, the wood is elevated to the top of the plant and fed to a battery of revolving cylindrical screens, in which the oversize is removed, to be put through secondary disintegrators and then returned to the main stream of chips. The screened chips are carried by belt conveyors to a large storage bin located above the extractor department.

The extractors in this factory are made of copper. The capacity is 6 metric tons each of ground quebracho wood. There are a number of them, operated in batteries of 6 each. Diffusion is accomplished with water which has been previously heated and which is pumped through the 6 extractors of a battery in series.

These extractors are of a modern type having drop



Courtyard of the Plant

The logs on the cars in the middle foreground are being taken to the chippers. Note the gasoline tractor, one of several that give good service at this plant.

bottoms and tops with hydraulic lifts and releases. With such equipment it requires but 15 minutes from the time the wood is spent and ready to discharge until the unit is again back in series in the battery. This includes removal of the extract from the extractor, discharge of the spent wood chips, refilling with fresh wood and operating the valves that again put the extractor back in the process. The light extract from the extractors, which contains an average of 7 per cent tannin, is pumped to evaporators. Concentration at a low temperature takes place in these evaporators. Heat is harmful to quebracho, as to most vegetable tannins, particularly during the concentration process, so that great care must be taken in designing this part of the plant and maintaining it under such control that the extract is not harmed.

After the evaporation of the "direct from the wood" quebracho extract to the desired 35 per cent tannin content, between 40 and 41 deg. Tw., it is pumped to various parts of the plant to be worked up into one of the commercial brands of extract. Each of these brands has certain characteristics of analysis and color and each is made for a different class of leather tanning. For sole leather tanneries a large quantity of extract of the following average analysis is used:

Tannins	35.00	per cent
Non-tannins	11.50	" "
Insolubles	0.45	" "
Water	53.05	" "

Total 100.00 per cent



Row of Wood-stave Storage Tanks for Quebracho Extract
This is one of two rows of tanks, each tank having a capacity of 7 tank cars or about 560,000 lb. of tanning extract.

This extract gives good weight, color and firmness to sole and other heavy leathers. Like all quebracho extract, it produces a strong, wear-resisting leather of long fiber.

The quebracho extract produced by this company is made to contain as near 35 per cent tannin as possible, being sold on this basis; and the purchaser pays more or less in proportion depending upon whether the chemical analysis shows more or less than 35 per cent tannin (or 65 per cent tannin in the case of solid extract). Quebracho extracts in comparison with other vegetable tanning extracts contain a higher percentage of tannin, that is, the ratio of tannin to non-tannin and insoluble content is high. On this account hemlock, chestnut, sumac, myrobalan and many other tanning extracts cannot be made to contain more than 25 to 30 per cent tannin except when produced in solid form.

HOW THE EXTRACT IS SHIPPED

The manufactured extract is shipped in tank cars and barrels to the tanneries. The tank cars are lined with a special enamel to prevent the extract from coming in contact with the steel shell, as that would blacken the liquid and the leather tanned with it. For this reason, also, throughout the manufacturing process the extract is permitted to come in contact only with cop-



Loading Tank Cars With Quebracho Extract

Most of the extract is shipped in tank cars which are brought up to the pier on barges and, when filled, delivered to the various railroad freight yards.

per, bronze, tin, lead, wood or other materials that will not contaminate it.

At the present time quebracho enters into the making of almost all leathers that are tanned with vegetable tanning materials. Its use offers many advantages. In the form of liquid extract it reaches the tannery vats ready for use. It simplifies and hastens the tanning process, yielding a high-class leather; firm, pliable and of good color. It blends well with other vegetable tanning materials. It controls undue fermentation in the tannery vats and reduces to a minimum the loss liable to occur from this condition.

There are maintained at this plant well-equipped routine and research laboratories. The routine laboratory keeps a constant check on each step in the manufacturing process and on the finished product. In the research laboratory problems are worked out concerning the production and use of tanning extract. In addition, a great deal of assistance has been given to individual tanners, at their request, toward the solution of the problems that they encounter in the course of their work.

Industrial Waste Disposal Stressed at A.I.C.E. Meeting

Technical and Legislative Control of Stream Pollution Discussed at Providence, June 24-26, by Chemical Engineers

Editorial Staff Report

HOW the vexing problem of stream pollution has been studied by several States, notably Pennsylvania was discussed by E. B. Besselievre, sanitary engineer of The Dorr Company, Engineers, in a paper entitled "Statutory Regulation of Stream Pollution and the Common Law."

Although the basic rule of the common law states that each proprietor has the right to have the stream come down to him with its quality unimpaired and its quantity undiminished, modern industrial growth has made necessary reasonable modifications of the foregoing principle. Regarding the responsibility of the individual manufacturer, the author stated:

"How far should a manufacturer go in providing treatment? It is obviously a financial hardship to compel or allow a manufacturer to carry treatment beyond the degree necessary to meet the demands of the case. Complete and full spirited co-operation between the health authorities and the manufacturer will prevent such unnecessary expenses, and will tend to a better understanding on both sides. The health authorities should make it part of their duty to inform the manufacturer how far he need go, and endeavor, as far as possible, to help him find the way. This will mean better results and quicker action."

"The wise course to pursue is to plan to devise a method that will meet the extreme condition and to construct a plant that will possess flexibility by use of individual units. The worst condition in pollution is usually in the summer seasons, when stream flows are low. At this period, the greatest degree of treatment is required. When stream flows are higher and the dilution greater, less treatment is required, and, at this time, certain units of an intelligently designed plant may be cut out, thus eliminating some of the cost of operation. Several of the States have recognized this principle, and plainly advise those faced with pollution problems, to make careful study along this line."

STUDY OF STREAM POLLUTION

In a paper entitled "The State vs. Industry or the State with Industry," W. L. Stevenson, chief engineer, Pennsylvania Department of Health, described the efforts of the Sanitary Water Board of Pennsylvania to enforce anti-pollution statutes and at the same time to secure the co-operation of industry in a broad program of conservation and utilization of water resources. As an illustration of how the plan might work, attention was focused on the tanning industry—one that has proved to be a bad offender in stream pollution. The following extract from the paper describes the plan and the important results already attained:

"The Bureau of Engineering invited the engineers and chemists of certain of the largest tanning com-

panies to a conference at which it became clearly evident that neither the State nor the industry had scientific worthwhile data concerning the amount of tannery waste which streams can inoffensively assimilate nor of reasonable and practicable ways and means for the treatment of tannery waste to various degrees so that the effluent could be safely discharged to the streams.

"The outcome of this conference was another one between the Sanitary Water Board and the executives of the leather tanning companies at which a form of agreement was approved and which was subsequently executed by practically all of the companies operating tanneries not in municipalities having sewer systems to which they have connections.

"This agreement provides for the creation of a fund of \$35,000 by contributions from the companies in proportion to their rated capacity in pounds of green salted hides a day.

"This fund is being expended by a committee consisting of three engineers and three chemists who are employees of participating companies and the chief engineer of the Sanitary Water Board, as chairman.

"The agreement provides for the construction and operation of a full-scale experimental treatment works by the committee and that if reasonable and practicable methods are found and approved by the Sanitary Water Board their installation at any tannery will be deemed compliance with the anti-stream pollution laws.

"The committee selected a tannery at Instanter, Elk County, Pa., as the site for the experiments because the stream now receiving that tannery's waste is not otherwise used or polluted for several miles and hence provides means for study of effect of various ratios of discharge of tannery waste both untreated and treated to various degrees.

"Gaging stations have been established to give the rate of stream flow at various points and sampling stations selected.

"The first work of the committee was to determine the rate and times of production and, by analyses, the chemical and physical characteristics of the 16 separate ingredients of the combined tannery wastes.

"These studies indicate that if certain of the intermittently produced acid and alkaline wastes are mixed together and allowed to naturally react upon one another that a heavy precipitant forms including considerable material originally in solution and that the supernatant liquor is markedly lighter in color than the combined wastes.

"These reactions promise sufficient success in preparation of the wastes for treatment that the committee has approved plans for constructing the first part of the experimental plant in order to try out the laboratory procedure on full scale.

"The program includes finding the maximum ratio at which untreated tannery waste can be disposed of in streams for application in cases of tanneries situate on large rivers. Also the ratio for tannery waste treated to various and increasing degrees of purification so that for any given rate of flow of stream and its use it will be known to what degree it need be treated and how to do so at the least expense."

HYDROGEN-ION CONTROL OF WASTE LIQUORS

According to Henry C. Parker, of the research department, Leeds & Northrup Co., electrometric control of waste disposal is the only satisfactory method when both flow and concentration of the waste liquor are changeable. Moderate changes in chemical composition of the waste liquor can be accommodated if the precipitation zone is moderately broad. These facts serve to emphasize the importance of adapting electrometric control to a practical solution of this problem.

By way of illustration, an experimental installation of automatic control in the direct oxidation method of sewage disposal at Allentown, Pa., was described. Application of control to this process was considered to be extremely difficult as from 30 to 50 p.p.m. of caustic alkalinity was maintained, and cleaning of the electrode every 8 to 12 hr. was necessary. Under these conditions, the electrodes lasted from 2 to 3 weeks, if used discontinuously. Cleaning of the electrodes is accomplished by scraping in distilled water.

Recent advances in manufacturing electrometric control instruments have made available a broad choice of indicating, controlling and recording apparatus. This should eliminate entirely the uncertainty involved in any scheme of manual control, and undoubtedly marks an advance in this type of technical measurement.

PROFITABLE WOOL GREASE RECOVERY POSSIBLE

The magnitude of waste from wool scouring and the possibilities in various recovery processes, was emphasized in a paper by F. P. Veitch and Leon C. Benedict entitled "Wool Scouring Waste Liquors Composition and Disposal." It is estimated that waste liquors from this industry contain at least 60,000,000 lb. of grease, 60,000,000 lb. of dirt, 40,000,000 lb. of potash salts expressed as potassium sulphate, and 15,000,000 lb. of nitrogen expressed as albumen. In marketable form these would be worth approximately \$5,000,000.

Various recovery processes were discussed, including (1) the acid-cracking process; (2) battage process; (3) treatment with gases; (4) steeping process for the concentration of potash, followed by the acid treatment; (5) Cardem process; (6) solvent extraction, and (7) centrifugal recovery. The authors' conclusion was that insufficient scientific research has been done on the problem, and that modifications in both scouring machinery and scouring processes must be made before profitable recovery can be assured. As considerable funds are necessary, such an investigation should be initiated and supported co-operatively by a group of wool scourers, at one of the scouring plants.

SILICA FOR HYDROCHLORIC ACID ABSORPTION

In a paper entitled "The Absorption of Hydrochloric Acid and Some Data Regarding the Tyler-Vitreosil System," Stephen L. Tyler described an S-bend absorption system constructed entirely of fused silica, which is claimed to be superior to either the tower or

tourill systems. The S-bend is not circular in cross-section, but has several features that aid in the efficient contacting of gas and liquid and in heat transfer between the aqueous acid in the absorber and the cooling water that flows over the outside. The roof of the absorbing vessel slopes from both ends toward a low point in the center, thus deflecting downward the gas passing through the system, and also providing a depression for cooling water.

The assembly of S-bends is one above the other, making for economy in floor space, ease of cooling and if necessary for thorough scrubbing, short compact intermediate towers can be installed. In this system, the gas and liquid pass through the same conduit, and there are no joints below the liquid level.

EVAPORATING SODIUM SULPHATE

"Evaporators for Salts with Inverted Solubility Curves" was contributed by W. L. Badger and H. B. Caldwell. The mechanism of scale-formation, which is the limiting factor in evaporating salts having inverted solubility curves, was explained well by the authors:

"One of the most difficult problems in evaporator design is the evaporation of solutions of a salt whose solubility decreases with temperature. Calcium sulphate is the most familiar example of this group, and the difficulties due to it have been so universally experienced that they need no further comment. It is not so generally understood, however, that *any* salt whose solubility curve is of the same type will cause similar difficulties. The commonest cases are those of anhydrous sodium sulphate, and sodium carbonate monohydrate.

"In evaporating a solution of any such substance, it is obvious that the stagnant layers of solution next the heating surface will be the hottest, and hence in them the material will be the least soluble. Since most of such inverted solubility curves are quite flat, a high degree of supersaturation (and hence a rapid rate of crystallization) cannot exist. This, together with the fact that the layer is stagnant, presents ideal conditions for crystallization in the form of hard coherent scale rather than individual free crystals. Once this layer of scale has formed, it salts out the supersaturation of the stagnant layer, and thus causes most of the solid deposited to be deposited as scale instead of free crystals.

"It should be noted that this is the only mechanism by which hard, coherent scale may be formed. If other insoluble substances be present, they may be more or less included in the scale, but without a substance whose solubility curve is inverted, scale cannot form. The case of "salting" or the building of a deposit of crystals of a substance having a normal solubility curve, is entirely different, as will be shown in a later paper."

Owing to the increasing importance of sodium sulphate in chemical industry, this salt was used in the present investigation. Of the theoretical basis for attacking the problem the authors say:

"The remedy is obviously along one or both of two lines: either increase the circulation so as to decrease the thickness of the stagnant film and tear off as much of this superheated material as possible; or second, furnish a plentiful supply of seed crystals which, since the circulation will carry them into the film at intervals, will seed out the supersaturation of this film and thereby decrease the rate of scale formation. These remedies,

however, will merely improve the performance of the machine. Since, even with the most vigorous stirring, the stagnant film can never be totally removed, it follows that there will always be some tendency to scale. The above methods may decrease this tendency to the point where a cycle of operation may be maintained of such length as to be commercially valuable."

When the experimental evaporator was operated in the usual way, a scale of sulphate $\frac{3}{4}$ in. thick formed in less than an hour, and boiling nearly ceased. This difficulty was solved by circulating under pressure superheated feed, which flashed under the basket of the evaporator, using the flash as a means of stirring and for supply seed crystals by which supersaturation of the liquor is avoided. A commercial machine was constructed on this principle, and having extra long vertical tubes with a large annular downtake. A double effect was used, each having 2 salt filters with large clean-out doors.

Difficulties of operation were such that special auxiliary equipment had to be designed. This included a high-pressure centrifugal pump for the external circulation of liquor, superheaters for the liquor to give the required flash, non-freezing liquor level gage, and extra steam jets and valves to facilitate maintenance. Practice was eventually perfected so that only two boil-out periods of $1\frac{1}{2}$ hr. each were necessary in 24 hr. operation, leaving 21 hr. for effective production. A comparison of the spray drying process of making anhydrous sodium sulphate with the double-effect evaporation process is of interest:

"This method of production of anhydrous sodium sulphate from its solutions by double effect evaporation has probably a lower cost of operation than any other system. If spray drying is considered, an enormous initial expenditure for equipment is required. Also it is impossible to make use of the multiple effect evaporation principle and fuel costs are inherently higher with the exception of the case where large quantities of waste heat at a high temperature are available. Furthermore, there is the difficulty of clogging up any nozzles that may be used in the design."

GLASS EVAPORATOR POSSIBLE

Attempts to concentrate orange juice without metallic contamination suggested the use of glass and stoneware as a material of construction for an evaporator. The construction and operation of such a machine was described by W. L. Badger and F. C. Cutting. For experimental purposes, an evaporator of a modified Yaryan design was constructed of 1-in. Pyrex glass tubes and stoneware receivers. The total heating surface was 11.76 sq.ft. With a vapor velocity of about 400 to 500 ft. per sec. and a temperature drop of from 52.9 to 108.1 deg. F., the over-all heat transfer coefficient ranged from 47.7 to 58.7 B.t.u. per sq.ft. per hr. per deg. F. temp. difference. Distilled water was used as feed in all runs of which 128 were made. That an evaporator of glass and stoneware has commercial possibilities is indicated by the authors:

"Since this experimental work was done, a commercial machine of 30 coils has been built for the concentration of dilute nitric acid. The coils are all of the same size and proportions as the experimental coil above described. It has not been in operation long enough to obtain data as to its performance, but preliminary reports say that it is operating satisfactorily.

"The question of the fragility of this apparatus is

raised by many who are not familiar with Pyrex. In the first six months of laboratory operation, involving starting and stopping the machine about 400 times, there were no breakages during operation. Three tubes were broken at one time or another by accident during alterations. No care was necessary in starting or stopping the apparatus; in fact, it is possible to have the machine boiling in two minutes from the time of starting.

"The work discussed above was done between December, 1923, and June, 1924. In March, 1925, the machine was again used, and caused considerable trouble due to tube breakages. It is not certain at this time whether or not these breakages were due to accidental shocks, but it seems more probable that the glass has crystallized during the year and a quarter that has elapsed. This point will receive further study.

"The general result of this work has been to show that an evaporator of glass and stoneware is entirely practical, and to give certain data illustrating the factors affecting its capacity and operation."

FINDING DRYING RATE EFFICIENCY

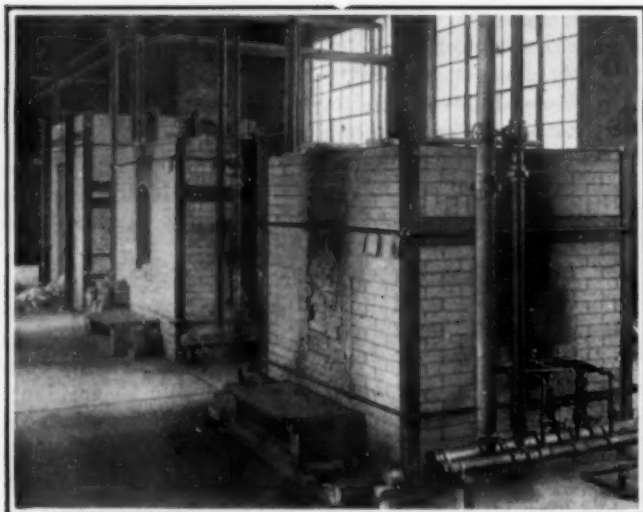
Finding the percentage drying rate curves of various commercial products was the object of an investigation by A. E. Stacey, Jr., research engineer of the Carrier Engineering Corporation, Newark, N. J. These curves were obtained by plotting the percentage moisture removed versus the percentage rate of moisture removal relative to the maximum rate of evaporation, i.e., the actual instantaneous rate of moisture removal in pounds per hour compared with the total removal of moisture attained in the drying process. For maximum evaporative efficiency it is obvious that the rate would begin at 100 per cent, remaining constant until dryness was reached.

OPTIMUM CYCLE OF EVAPORATION

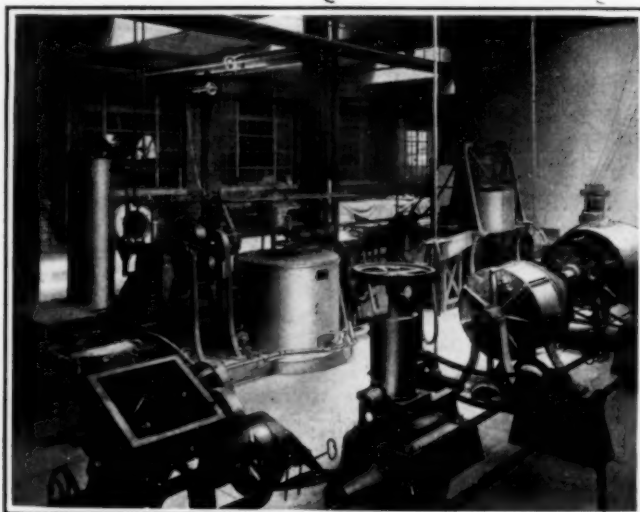
Determination of the optimum cycle for liquids that form scale was reported by W. L. Badger and D. F. Othmer. Hard water containing 280 p.p.m. of CaCO_3 and 156 p.p.m. of CaSO_4 was evaporated in an experimental Yaryan evaporator having one iron tube $2\frac{1}{4}$ in. in diameter and 50 ft. long. The boiling point was 210 deg. F., and the steam temperature 286 deg. F. Curves showing the over-all coefficient heat transmission as a function of time were prepared, and from these curves substitution can be made in an equation that gives total evaporation per 24 hr. as a function of heating surface, working temperature drop, length of working cycle, time for cleaning and heat input. The authors point out that the cycle of maximum production may not be the cycle of minimum cost. "This depends on the relation of operating to overhead costs, on the ratio of boiling time to cleaning time per cycle, and on the ratio of cost per hour for labor for cleaning to cost per hour for labor for operating. Low overhead costs and high costs for cleaning tend to longer cycles, and vice versa."

Editor's Note:

Papers on "Electrolytic Calcium Arsenate" by Stewart J. Lloyd and "Future Gas Supply—a Challenge and an Opportunity," by W. M. Russell appear in part elsewhere in this issue. "Improvements in the Technology of Thickening and Clarification," read by Noel Cunningham will appear in an early issue, and a description of the "Super-thickener" is included in the "Equipment News" department this month.



Battery of Recuperative Kilns for Experimental Burning



View of Grinding and Mixing Room at the Bureau

Raw Materials of the Ceramics Industry

Continuation of a Series of Articles Describing Some Recent Investigations of the Bureau of Standards

RAW materials entering into various ceramic products comprise not only the cheapest unrefined surface clays that can be used in making common brick, but in addition a large variety of carefully mined, selected and refined clays, often brought half way around the world to the point of consumption. A wide range of inorganic oxides, salts, and metals including gold and platinum, are used also. Few realize that the service placed before them in some of our better hotels may have as a decorative feature \$1 or \$2 worth of gold on them, and that the same plate, with platinum replacing the gold, is a commercial article.

Gold is used on such relatively cheap wares as terra cotta. One store front in Chicago was faced with terra cotta having \$7,000 worth of gold on it. Although the preparation of the gold and platinum in the so-called liquid form, and its application, is almost a secret art, it is at the same time a good example of the desirability of research on these raw materials so that the supposedly hidden secrets may be known to all. However the kaolins, ball clays, whittings, flints, feldspars, and the oxides used for opacifying glazes, such as zirconia, tin oxide, aluminum, etc., still have hidden in their physical and chemical properties, and in the correlation of these with plant procedure and quality of the ware, equally interesting problems for research. A large number of these researches have been done at the Bureau of Standards, and will provide investigations for an almost indefinite period.

Properties of English and American Ball Clays—The potter in particular has a leaning towards foreign clays. This branch of the industry has always followed foreign, and especially English, precedent; hence the tendency to use foreign raw materials, and the Bureau's attempts to educate the industry in the qualities of our own raw materials. In one piece of work the bonding effect of 7 American and 14 English ball clays were compared: (a) After burning, in a composition containing no fluxes, at cones 5, 8, 10, and 12; (b) in a

semi-porcelain body burned to cone 8 and (c) in a vitreous china body burned to cone 11. The English clays developed greater strength in the absence of the fluxes. The semi-porcelain and vitreous china bodies containing the imported clays were in general of greater strength than those bodies in which the domestic clays were used, but most of the bodies containing American clays possessed good transverse strength.

Potters' Flint—Flint as used in the pottery trade is of 3 distinct types, namely, the crystalline variety of silica known as quartz, the true flint, also known as cryptocrystalline quartz, and French flint. Seventeen samples representative of the 3 types were obtained from the trade and tests made to determine: (a) firing behavior, including determinations of porosity, absorption, volume firing shrinkage, and bulk specific gravity at cones 6 to 14; and (b) corresponding porosity, absorption, bulk specific gravity, and transverse strengths of the different bodies when these were fired to maturity. In addition, data were obtained on the true specific gravity, micro-structure, formation of mullite and cristobalite, thermal expansion, inversion points, and relative resistance to failure in dunting and quenching tests. The results obtained indicate that the particular kind of flint used has little influence on the relative resistance to dunting, although it is the presence of the flint in the body which is directly responsible for the failure.

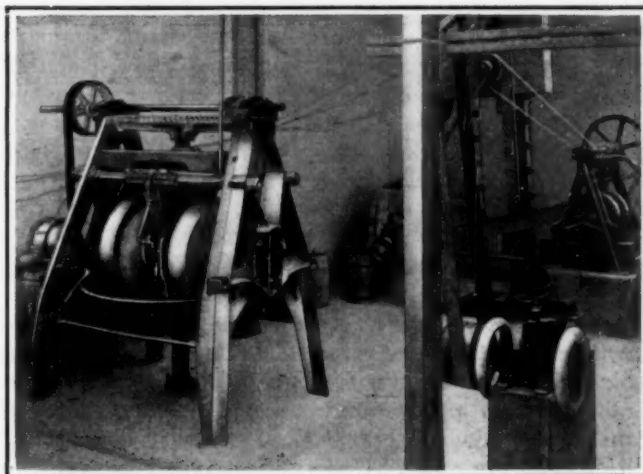
Apparently the use of American pulverized quartz sand or rock produces bodies slightly more resistant to thermal shock than bodies made with French flints, but the degree of vitrification of semi-porcelain ware has the greatest influence on resistance to cracking when quenched. On the other hand, French flints produce bodies of slightly higher resistance to dunting. The substitution of a very fine flint for one of ordinary fineness causes a marked increase in the degree of vitrification with an accompanying increase in strength, but much greater liability to failure on quenching. Vice

versa, the substitution of a coarser flint for one of ordinary fineness in a vitreous body causes this body to remain slightly more porous and with less transverse strength after an equal burning treatment.

Effect of Salts on Clay Suspensions—The aim of the study is: (a) To obtain physical-chemical constants for the preparation of specifications for clays for specific purposes, and also applicable in processes of their purification, and (b) the regulation of clay bodies for forming ceramic wares.

The first phase of the study related to the pH of the solution phase of the clay-water system, as determined by the hydrogen electrode, and the effect on the rate of settling of 3 classes of clays. The results were published in Bureau of Standards *Technologic Paper No. 234*.

Every commercial brand of clay, even when fairly uniform in superficial physical properties, and the rela-

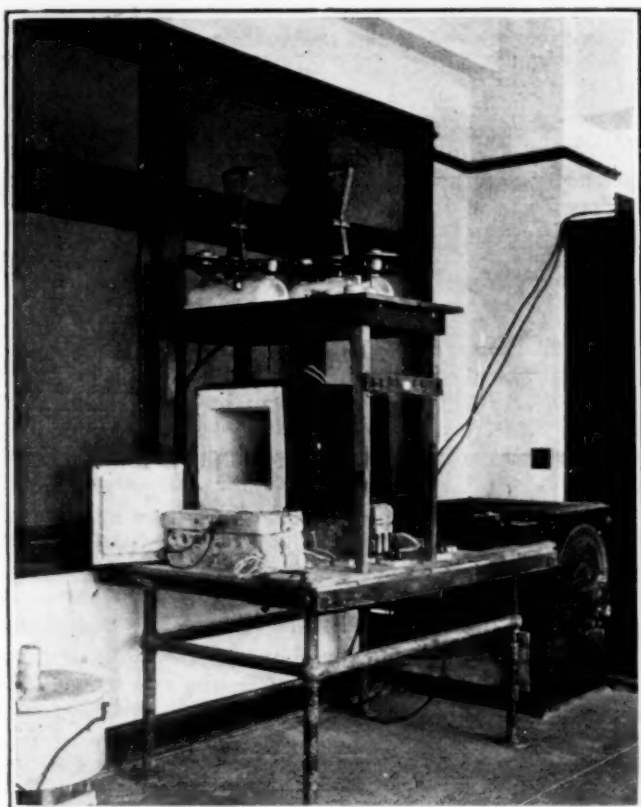


Crushing and Coarse Grinding Equipment at the Bureau

methods of attack and control of results, has led to the construction of a battery of horizontal leaching cells. The experiments have confirmed expectations, in that leaching has increased the volume of the slip 13 per cent.

Paper Clays—In connection with an investigation conducted by the paper section of the bureau for the purpose of comparing American and foreign clays as paper fillers, a short study of the clays themselves was conducted for the purpose of determining what relation, if any, existed between the physical properties of the clay and its retention in paper. The essential requirements of clays for paper making are: Good white color, low content of grit, mica and other impurities; and uniformity. In addition to tests of these obviously necessary qualifications, further work was also done to determine the volume shrinkage, water of plasticity, transverse strength, ratio of pore water to shrinkage water, the true specific gravity and the relative plasticity.

Examinations were conducted on 38 samples, 18 of which were of foreign and 20 of domestic origin. It was found that domestic clays compare favorably with the foreign material as regards color. Microscopic examination of residues from 8 typical clays showed these to consist principally of quartz and mica. The total residue on the 300-mesh screen varied from 0.34

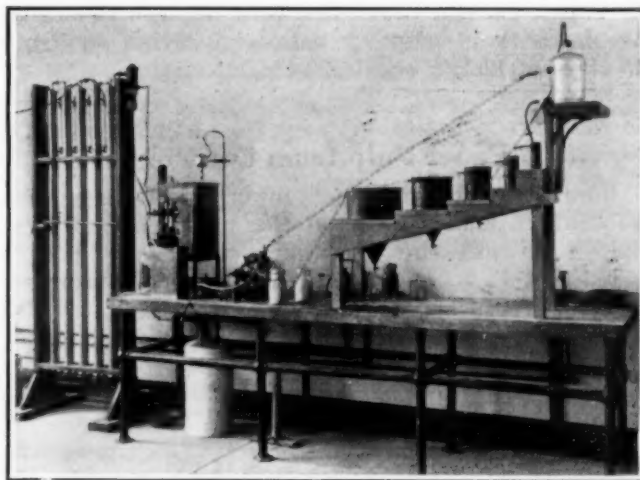


Determining the Loss in Weight of Clays

Furnace and equipment to remove water not previously driven off in the driers.

tion of main chemical constituents, silica, alumina, ferric oxide, and combined water, varies widely in the relation of the proportions of the contained soluble electrolytes—the basic oxides. In order to study a clay synthetically and co-ordinate the basic character and composition with electrolytes and added colloids, and to make comparison with other clays of similar type, it is necessary to remove the original disturbing elements. This is being done by the natural process of leaching with distilled water containing carbon dioxide, as in the formation of gumbo clays. The material chosen for the study is a moderately plastic china clay that has been used widely by American potters and paper makers for over 30 years, with a reputation for uniformity. For comparison, a very pure residual kaolin, with practically no plasticity, is being used.

The problem of a suitable technique, with different



Apparatus for Testing Clays

On the right is an elutriating device for classifying the particles. On the left is an apparatus for determining the plasticity of clay slips.

to 1.40 per cent. The method used for comparing the plasticities is described in Bureau of Standards *Technologic Paper* No. 234. Of the 8 clays examined, both the material of greatest plasticity and that of least plasticity were of American origin. Similar comparative tests, of the foreign and American materials, of the nature previously described, did not show any decided advantage of either clay, and no correlation was found between the physical properties of the clays as determined and their relative values when used as paper fillers.

Properties of Clays as Affected by the Drying Treatment—Practically all clay products must be dried before being placed in the kiln for burning. This is a considerable part of production cost, and may be increased considerably due to breakage of ware if drying conditions are improper. Clays differ considerably in the rate and time at which the water is given off, and consequently the amount of resultant shrinkage at any time. The determination of this feature alone, as well as the developing of economical drying under properly controlled humidity conditions, is a fundamental study now under way at the bureau.

The laboratory work of the first phase of this study, consisting in the determination of the effect of drying treatment on the strength and other properties of laboratory test specimens of different types in clays and commercial bodies, is nearing completion. Data have been obtained on the rate of moisture diffusion through clay, the rate of removal from the surface, and the rate of temperature rise within a body while being dried. The modulus of rupture has been determined on pieces retaining from 0 to 12 per cent residual moisture at 110 deg. C. Although the increase in strength with reduction of moisture content varies in different clays, it has been found that the removal of the last 1 per cent increases the dry strength from 50 to 100 per cent. In addition, clays varying widely in composition and pore construction have been aged in the dry state for various lengths of time, and have also been subjected to identical drying treatments in order to determine the effect on the physical properties of the clays. Interesting data have been obtained, but definite conclusions at this time are not warranted.

The second phase of the investigation has for its purpose the correlation of drying treatment with the physical properties of the clays, in order that information may be established that will be of assistance to the industry in adapting industrial drying equipment to clays of known physical properties.

Paper Pulp from Corncobs

Iowa State College, Ames, Iowa, reports in a recent publication, *Bulletin* 73, on the production of paper pulp from corncobs. In this connection it may be noted that F. B. La Forge in his work on the production of furfural from corncobs, obtained as final product, after extracting other matter from the cobs, a white, nearly pure, residue of cellulose.

Recently, in the Engineering Experiment Station of Iowa State College, R. S. Toman and J. R. Mudge prepared paper pulp from the corncobs direct with some degree of success. The crushed cobs were digested in an autoclave, without agitation and the liquor separated from the resultant pulp by a centrifuge. In handling the cobs in this way, a considerable part of

the gums and resins of the untreated cob were retained in the pulp, giving the paper when finished a certain amount of glaze.

The pulp from the centrifuge was thoroughly treated in a beater, until all the hard particles had been worked out. This pulp from the beater was of a dark brown color, creamy in consistency and very colloidal. Also the fibers were extremely short, most of them being less than 2 mm. long.

From this pulp, when sufficient skill in handling had been attained, a high grade of paper, of high tensile strength and with a glaze, was obtained. The experimenters also tried this pulp in combination with straw pulp and found that it worked well. They suggest that a mixture of corncobs, oat straw and cornstalks might well be utilized as the raw material for making paper board, the inclusion of the corncobs producing a board of greater strength and greater resistance to water.

In this connection it is interesting to note that, if ground corncobs are treated with a concentrated solution of sodium hydroxide and then balled in a mill, a plastic, gummy mass results. On washing this free from caustic, it can be made into a mat that on calendering forms a cardboard of great tensile strength. Cardboard made in this manner shows much greater resistance to moisture than ordinary cardboard.

"Weed" Wood for Paper Pulp

At the time of the fire which destroyed Cloquet, Minn., in 1918, the pulp mills of that vicinity had only about 2 years' supply of raw material available. A large part of this was destroyed by the conflagration and the mills were faced with the alternative of shut-down or the development of some other wood fiber than spruce for the manufacture of pulp.

The latter alternative was accepted and the accomplishments along this line to date at the plant of the Northwest Paper Co. have been pointed out by H. Oldenburg of the Weyerhaeuser Lumber Co., in a paper read before the National Conference on the Utilization of Forest Products and published in U. S. Department of Agriculture, *Miscellaneous Circular* No. 39, April, 1925.

According to Mr. Oldenburg, the Northwest Paper Co., formerly manufactured 60 tons of newsprint paper per day from pulp made from spruce and balsam. Since the fire, the mill has been entirely reconstructed and enlarged so as to use 100,000 cords per year of little-used woods, such as aspen, birch, jack pine and tamarack, for making book and wrapping papers. This plant is not yet producing standard stocks in commercial volume, but what has already been accomplished gives assurance that the product of these "weed" woods will make the best book paper manufactured.

In addition, the Wood Conversion Co. has been organized to utilize mill waste. It has developed the process of making balsam wool for insulating, sound deadening, and other purposes from the screenings of the paper mill and mill waste, and now turns out about 7,000,000 ft. of this product per year. It has also conducted extensive researches leading to the production of a synthetic board from such waste materials. Other factories are also using these wastes, one constructing refrigerators in which balsam wool and synthetic board are used; while another makes paper roll plugs, paper frames, wire reels and other products from the same raw material.

Engineering the Element of Surprise Out of Business

Application of the Scientific Method to Business by Technically Trained Men Can Give Many Valuable Results

By H. C. Parmelee

Editor, *Chem. & Met.*

IT IS APPARENT to none more than ourselves and similar technical organizations,* how profoundly science and engineering have influenced American industry within the life of this society, and how dependent is our future progress upon the foundation of sound technology. There are few great industries in the base and structure of which the work of the engineer is not essential, if indeed it does not constitute the very cornerstone. From this one might draw the conclusion that the scientist, the engineer and the technologist are of the utmost importance, if not indispensable, in industrial development. Indeed the signs are not lacking that the technical man himself has occasionally drawn this conclusion to the disparagement of the other factors in producing and distributing the products of industry. But for some reason or other, he has not fully convinced the remainder of the world that he is the most important element in industry. There is somewhere a missing link in his qualifications which weakens his argument, with the result that neither is he satisfied with his own lot nor are his business associates fully persuaded to accept him at his own valuation. This is apparent in the plaintive cry that has gone up from the chemist that he is not appreciated, and from the engineer that he should be given a larger part in the conduct of business, civic and political affairs. It is evident also in the probing of our present methods of technical education in an attempt to discover their deficiency in training for greatest usefulness.

I should be the last to disparage the technical man, nor am I disposed to do so. In fact I have openly been his champion. But—and here I begin to reflect opinion from competent sources—there is increasing evidence that the engineer or technologist has been made to do only half his job in training and study. Consequently he is only half prepared for his greatest usefulness in business. In his circumscribed field he fails to see that technology is not always the most important factor in industry, and that the problem still remains for someone to capitalize his knowledge and ability and run the business in such a way as to make money.

The thesis can be expressed briefly thus: According to present methods of education the technical man is apt to become a narrow specialist, regarding his scientific and engineering knowledge as an end in itself and something entitling him to special recognition. Consequently he fails to relate it properly to the other necessary elements of business, namely, financing, management, purchasing and distribution, all of which keep more definitely in mind the important point of making

a profit. One of the results is that the business executive is tempted to regard the technical man as a visionary and impractical fellow, an expensive luxury, while the latter is apt to get the impression that the business man underrates him.

Against this picture, which is manifestly exaggerated and unfair to both parties, let me develop this one: That the engineer with his technical training and common sense, supplemented by an elementary knowledge of business, economics and psychology, is particularly well fitted to assume the largest responsibilities of management. He is qualified to co-ordinate research and production with purchasing and sales in such a way as to produce a smooth-running profitable business machine. His great asset is the engineering habit of mind, the scientific method of approaching a problem, and he can double his value and opportunity by bringing this method to bear on the business as well as the technical phases of industry.

I need not elaborate for you the engineering method of approach. Its elements are keen observation, organized experimentation, rational analysis and intelligent interpretation of the results. These things are fundamental to every well-trained scientist and engineer. For the most part they have been applied in scientific research, engineering development and plant production, but according to the testimony of successful executives, have been neglected in such important economic matters as location of plant, purchase of raw materials, sale and distribution of products, disposal of by-products, financing and budgeting and other similar phases of industry. Since these problems are amenable to the same methods of research, experimentation, analysis and interpretation that the engineer applies to technical matters, it is but a short step to extend those methods into the new field.

What, then, is the function of engineering and science in business? To forestall the element of surprise, or as one executive picturesquely puts it, to eliminate the casual from business. We have only to pause for a moment to see that these two expressions—forestalling the element of surprise and eliminating the casual—crystallize into useful slogans the whole aim and purpose of science and engineering in industry. The mechanism of accomplishing this purpose may be summarized in another slogan: Get the facts first and interpret them honestly. Here we must emphasize "honestly" because some executives indulge in the foolish pastime of gathering information and data and then interpreting them to support their preconceived opinions. Or they draw general conclusions from insufficient data. Scientists and engineers, however, are very likely to be fundamentally honest in these matters

*Excerpt from presidential address, American Electrochemical Society, Niagara Falls, April, 24, 1925.

because they are accustomed to dealing with the fixed and immutable laws of nature with which they may not trifle with impunity.

As technical men we are familiar with these things and accept them as axiomatic in our scientific and engineering work. But they have not yet been translated into the realms of business and politics nor will they be until the engineer introduces them. And when he does, he will reap the reward of recognition which he is now denied.

THE ENGINEER VERSUS THE POLITICIAN

The point may be made clearer if we contrast the engineering method with, say, the congressional method of solving a problem. The very juxtaposition induces a smile, for political methods are notoriously unscientific. The point will be clearer still if we take specific problems, such as the disposal of Muscle Shoals, the determination of postal rates and salaries and the relation of industrial alcohol to prohibition. In approaching any one of these problems Congress will adopt the method of holding hearings at which witnesses of varying degrees of competence and incompetence will testify. It will then publish these hearings at great public expense, file them in the archives of the government and then decide the question on the basis of political expedience and personal predilection. The engineering approach on the other hand would involve systematic investigation, careful analysis, and interpretation based on economic and scientific facts. Thus the future consequences of the final decision would be free from casual influence or the element of surprise.

But if we are able to cite the Federal legislature as a horrible example, it is fortunate that we can also turn to a government department for inspiration and encouragement. The Department of Commerce is the great exponent of American business and fortunately embodies the engineering habit of thought in its executive head. Mr. Hoover has long been a striking example of the engineer in business and his methods have filtered down through the great body of American commerce and industry with definite but untold benefit. The mere catalog of his activities during the past four years exemplifies what can be done to eliminate the element of surprise from business, to know where we are going before we arrive, to chart the course before we set forth. The engineering approach has been evident in his study of the business cycle, his disclosure of national and industrial waste, his recognition of the legitimate functions of trade associations and his intelligent use of business statistics. The program of simplification that has already been carried out under his direction has resulted in a common sense view of production and distribution on the part of many industries that were wallowing in the mire of unprofitable business. And he is now looking ahead to a census of consumption and a reduction of waste in distribution that will bring still further benefits to business. These things have not happened casually but have been engineered in the best sense of the word and they stand as shining examples to great industries and individual manufacturers of the value of bringing the engineering habit of thought to bear on business and economic as well as technical matters.

Returning to our own field of work it must be apparent what opportunities there are for applying the methods of science and engineering to the business and economic aspects of industry. In the unwise location

of plants the greatest opportunity exists for the element of surprise to plague the executive if he has not carefully studied the problems of transportation, labor, power and water supply, waste disposal, public nuisance, access to raw materials and distribution of finished product. The casual can be eliminated from purchasing and sales only when a thorough knowledge of production and consumption, imports and exports, stocks and prices, competition and substitutes, costs and profits is carefully attained. And having a knowledge of these unrelated facts they must be correlated and interpreted intelligently.

There is abundant evidence that these things are only vaguely appreciated or comprehended by many of the non-technical executives, purchasing agents and sales managers in industry. Not only are they unaware of the importance of economic data, but they are unfamiliar with the sources of such material or with methods of investigation that will discover it. My mail is generously sprinkled with inquiries from non-technical executives who show a surprising ignorance of these things.

THE TECHNICAL EXECUTIVE STANDS OUT

The technical executive, on the other hand, is better equipped. Even if he has never supplemented his science and engineering with business and economics, at least he makes an intelligent approach to his problems. Perhaps he realizes his deficiency and remedies it by study. I have the testimony of one technical executive, a vice-president in charge of research for one of our large corporations, that within a month after taking his job he realized that he would never succeed without a broader knowledge of business, finance and economics. Accordingly he took an organized course of study and read many books. In the end he found himself better equipped than his associates because he knew not only the technical but also the business and economic phases of his industry.

Obviously the subject is large enough to warrant a comprehensive treatise rather than a brief sketch, but enough has been said to show the value of extending the scientific and engineering habit of thought into the business and economic side of industry. The value of science and engineering has been fairly well established and proved on the technical side, but a still larger field of usefulness awaits their application.

The question may be raised, What are we going to do about it? The answer is to be found in a broader and more liberal education of the engineer and technologist.

These things are being keenly appreciated in our progressive colleges and universities, with the result that broader and more liberal courses in science and engineering are being offered, and the time required for obtaining an engineering degree is being extended from four years to six. The best minds in both education and industry see the need of a new order. To science we must add economics; to mathematics, accounting and the interpretation of statistics; to engineering, the problems of finance; to production, a knowledge of distribution and consumption; and to all these a broader understanding and comprehension of the human element. Unless the testimony of some of the most capable executives in our technical industries is at fault the adoption and execution of this program will influence profoundly the efficiency of industrial production and remove to a large degree the element of surprise from American business.

The Gas Industry's Challenge to the Chemical Engineer

Future of Process and Products Awaits Solution of Chemical and Engineering Problems

By W. M. Russell

Gas Engineer, Gas and Electric Improvement Co., Boston, Mass.

IT IS confidently expected that the next decade will bring an increase in the requirements of gas supply out of all proportion to the existing capacity of plants and distribution stations. This expected great increase in the production of gas will call for tremendous investment in manufacturing plants and distribution systems, and an enormous increase in the consumption of the raw materials which enter into gas manufacture.

The gas engineer will be confronted with two problems—first, the process—and second, the supply of raw material. At the present time there are two widely used processes. The distillation of coal, whether in retorts or in byproduct coke ovens, supplies a considerable proportion of the total gas supply of this country, and this process produces, as a residual, valuable byproducts in the form of coke and tar. By far the largest amount of gas, however, is made by the so-called "water gas" process which utilizes coke or anthracite coal as a fuel wherewith to form blue gas from the action of steam upon it, which is then carburetted or enriched by the addition of oil.

CHEMICAL ENGINEERING OPPORTUNITIES

Aside from the generation of gas, the business of gas manufacture offers many problems. The purification of gas is a chemical process and it has never received the attention from chemists and chemical engineers that other great industrial processes have received in this country. Very recently efforts have been made to eliminate the present cumbersome methods of removal of hydrogen sulphide in gas. These experiments have been, to a great degree, successful, and are highly encouraging, but the field is open and further great improvements are possible.

Until very recently the thought of heating houses and business buildings with gas from the city mains has been considered rather fanciful, but at the present time, the situation is rapidly becoming very different and several large companies are securing great success in heating by gas, utilizing appliances designed expressly for this purpose, operating at maximum efficiency. The question of rates has held back the development of heating business, but it is now believed that with an assured market a rate may be expected. This will mean a tremendous increase in the amount of gas required in this country so that the gas industry is prepared to assume the cost of research and to finance the construction of new plants to meet the changed conditions. The gas industry as a whole has never received much attention from the chemical engineering profession. There are few mechanical problems which gas engineers have not satisfactorily met, and it is safe to say that any problem which is likely to arise the mechanical engineers can meet, but the chemistry of gas manufacture has not been developed. It is true that the gas industry has not welcomed chemical engi-

neers. Many chemical engineers do not know that there are any opportunities for them in the gas business, and perhaps until recently there have been few opportunities. This situation is entirely changed. The gas industry is now in a position to challenge the chemical engineering profession to solve its problems.

I submit that the solution of these problems offers a great opportunity for chemical engineers. I do not believe there is any industry in this country which is more ready to receive attention from chemical engineers or which has more pressing problems for solution, or which can offer any greater rewards for inventors and developers of existing or new processes.

One of the greatest problems and opportunities lies in a process of gas manufacture which will utilize bituminous coal with either the admission of very little oil, or eventually no oil whatever. This process should take bituminous coal capable of coking and containing a rather high volatile content, and completely convert it into a mixture of coal and water gas, leaving as a residue only ash and clinker. It should be so designed as to distill all of the coal gas from the gas coal before the resulting coke is gasified by steam in the blue gas section of the process. The coal gas and blue gas should enter the same gas container and be distributed in mixed form. The machine should be so built as to utilize all of the waste heat derived from the process of blowing the coke fire prior to steaming it in making blue gas, and this waste heat should be utilized in some manner to distill the gas coal and form the coke. Equipment should be included to allow of the admission and carburetion of gas oil or in the future of heavy grades of fuel oil. The process must be in a self-contained machine capable of operation by one man, and as near automatic in its control and operation as possible. With the present heating value standards, it will be necessary to arrange for the use of some oil, but if all of the coal gas can be distilled and saved, a very considerable proportion of the oil now required would be eliminated.

With the coming of lower B.t.u. standards which many gas engineers recognize as more or less imminent the elimination of that part of the machine having to do with the fixation of oil can be expected and a very simple process would result.

Such a process capable of operating on the cheaper grades of gas coal now available and designed to handle successfully such heavy grades of oil as are not now considered suitable for gas making would secure the attention and favorable consideration of every gas engineer, and should go far toward solving the great problem of the future gas supply in the average community in the United States.

Phosphate Rock in 1924

The phosphate rock shipped from mines in the United States in 1924 amounted to 2,771,000 long tons, valued at \$9,740,000, according to preliminary figures made public by the U. S. Geological Survey. Florida, the leading state, shipped 2,336,000 long tons, worth \$7,507,000, more than nine-tenths of which was land-pebble phosphate. Shipments from Tennessee and small quantities from Kentucky amounted to 396,000 tons, worth \$2,039,000. Idaho, Montana and Wyoming made small shipments. The phosphate rock mined in the United States in 1924 amounted to 2,756,000 long tons.

Abstract of paper read at semi-annual meeting, American Institute of Chemical Engineers, Providence, R. I., June 23 to 25, 1925.

Electrolytic Calcium Arsenate

Development of a Unique Oxidation Process
That Yields a Satisfactory Commercial Product
From the Unpurified or Gray Arsenic

By Stewart J. Lloyd and A. M. Kennedy

Gulf States Chemical & Refining Co., Birmingham, Alabama

ARSENIC appears in insecticides in two forms, as trivalent arsenic in the arsenites and as pentavalent arsenic in the arsenates. Generally speaking, the arsenites are cheaper and more toxic than the corresponding arsenates and would be widely used were it not that they are much more dangerous and are destructive to foliage. As the raw material from which practically all arsenic compounds are made is common, white arsenic (As_2O_3), some means of oxidizing this to the pentoxide (As_2O_5) form must be adopted in order to produce the arsenates.

During the early part of 1923, when there was expected throughout the South a large shortage of calcium arsenate, the Alabama Power Co., operating in the heart of the cotton belt and dependent for its prosperity on the prosperity of the cotton farmer, adopted the suggestion of one of its engineers that a study be made to determine whether an electrolytic process could be devised for the oxidation of white arsenic which would lower the cost of production of calcium arsenate, provide a local and convenient source of supply of this material for the cotton farmers and secure an additional power consumer for the company.

The preliminary experimental work was carried on, first at the plant of the Federal Phosphorus Co. at Anniston, Ala., where it was found that white arsenic could be oxidized electrolytically with very simple laboratory apparatus and later at the University of Alabama where it was shown that the electrical or current efficiency of this oxidation was high. The General Electric Co., having heard of the work, offered the facilities of its research laboratory at Schenectady where it was shown that the process could readily be reduced to a commercial state since, except for the electrolytic cells, stock chemical apparatus could be employed throughout and further that these cells presented no great difficulty in design and should therefore be constructed readily and cheaply.

Although the cost of the research work was borne by the Alabama Power Co., all of the patent rights were disclaimed by it and were left entirely to the inventors.

During January, 1924, the Gulf States Chemical and Refining Co. of Birmingham, Alabama, was reorganized to operate the process commercially.

OUTLINE OF THE PROCESS

White arsenic is dissolved in caustic soda in the proportion of 198:250 parts to form a basic, sodium arsenite solution. When this is electrolyzed between iron electrodes, hydrogen and a small amount of metallic arsenic (about 1 per cent of the As_2O_3 used) are produced at the cathode. Only a very small amount of

oxygen is evolved at the anode, the remainder serving to convert the sodium arsenite to arsenate.

When the oxidation is completed, the solution is filtered to separate the metallic arsenic and the filtrate added to a suspension of calcium hydroxide. The sludge is filtered and the precipitate of calcium arsenate, washed and dried. The filtrate of caustic soda, after being concentrated, may be used to dissolve fresh arsenic. The raw materials are therefore white arsenic, hydrated lime and sufficient caustic soda to replace the inevitable losses of the operating cycle.

It has been shown that the use of purified, white arsenic (99 per cent As_2O_3) which is required with the nitric acid process, is not necessary with this process, but that the unpurified, first roast, precipitate or gray arsenic (90-95 per cent As_2O_3) may be used, thus saving the cost and losses in re-roasting the arsenic to purify it.

The sequence of changes may be represented by the following equations:

1. $\text{As}_2\text{O}_3 + 6\text{NaOH} \rightarrow 2\text{NaAsO}_2 + 4\text{NaOH} + \text{H}_2\text{O}$
2. $2\text{NaAsO}_2 + 4\text{NaOH} + (\text{current}) \rightarrow 2\text{Na}_2\text{AsO}_4 + 2\text{H}_2$
3. $2\text{Na}_2\text{AsO}_4 + 4\text{Ca}(\text{OH})_2 \rightarrow (\text{CaO})_2\text{As}_2\text{O}_5 + 6\text{NaOH} + \text{H}_2\text{O}$

It will be noticed that the proportion of lime to sodium arsenate used does not produce the tri-calcium arsenate known to the chemist. The extra molecule of lime is used to produce a commercial article in which the water solubility of the As_2O_5 is sufficiently low to avoid any danger of "burning" or injuring the foliage of the cotton plant.

Fig. 1 shows a current efficiency—oxidation curve obtained at the General Electric Co. Research Laboratory. Fig. 2 is a flow sheet showing the course of material through the plant and Fig. 3 shows the arrangement of the chemical apparatus.

OPERATING PROCEDURE

In plant operation, a 10 per cent solution of caustic soda is made up in a 6,000-gal. horizontal tank (No. 1) fitted with a vertical sump pump. As it is necessary to make up a large amount of solution only when starting the plant in operation, it has been found convenient to make up the small amount needed to replenish the daily loss due to leakage by placing the solid caustic in a large pan discharging into the rear of the horizontal tank and circulating the contents of this tank over the caustic by means of the sump pump until solution is complete. By this means, a uniform mixture is provided and the stratification of layers of solution having different densities is avoided.

In making the mixture of sodium arsenite in tank 5, precautions were necessary to prevent the danger of poisoning the operatives with arsenic dust. This tank

A paper read before the American Institute of Chemical Engineers, Providence, R. I., June 25, 1925.
Patent No. 1,517,516 of Dec. 2, 1924.

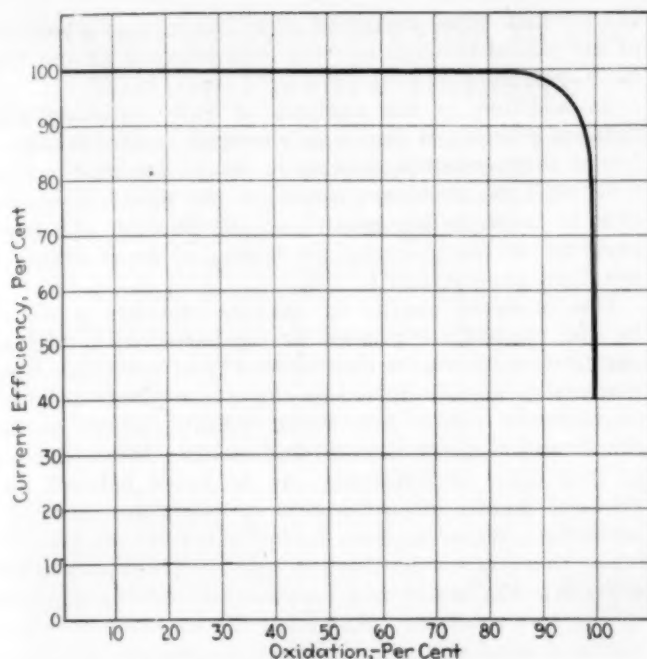


Fig. 1—Current Efficiency-Oxidation Curve for Electrolytic Calcium Arsenate

It will be observed that for the first 85 per cent of the oxidation, the current efficiency is practically 100 per cent while over the whole range of oxidation, this efficiency is about 85 per cent

is closed on top by the charging platform, and to carry off any dust which may occur, is connected with the boiler stack which, in this plant, is unusually large. To prevent dust, the arsenic is removed from the keg as a liquid by providing in the platform floor a grating in the center of which is a nozzle connected to the caustic soda sump pump of tank 1. In handling the white arsenic, the friction bung in the head of the keg is removed, the keg inverted over the grating and caustic soda pumped through the nozzle until the keg is emptied and cleaned. When a sufficient amount of arsenic to make up a batch has been added to the tank in this manner any additional caustic soda solution required to give 1 part of As_2O_3 to 1.25 parts of NaOH is run directly into the tank. The agitator is then started and kept running to insure thorough mixing.

From the mixing tank, the sodium arsenite solution is conveyed to the electrolytic cells by gravity.

It had been determined from laboratory work, that 30 amperes per sq.ft. of single electrode surface could be used with sheet iron electrodes through a solution of sodium arsenite without over heating, that to produce this current density required about 3 volts per cell and that the plates could be used as bi-polar electrodes.

As the motor-generator sets acquired from the Alabama Power Co. produced direct current at 600 volts, it was necessary to design the cells so that 200 plates could be used in series.

The final cells consist of boxes or vats 8 ft. 6 in. long, 5 ft. wide and 4 ft. deep, made of Alabama marble, 4 in. thick and slotted on 1 in. centers to receive 101 iron plates each $\frac{1}{8}$ in. thick and having seven $\frac{1}{4}$ -in. holes through one of the short ends and assembled so that these holes were consecutively on opposite sides. This marble was selected by the plant superintendent, W. F. Nagel, after a series of tests to determine a material which would withstand the action of hot caustic soda solution and at the same time retain its insulating quality.

The sodium arsenite solution is admitted at each end of the cell and is returned from the center. This return is piped to a 6,000-gal. tank (No. 2) and when the mixing tank (No. 5) had been emptied, is kept circulating through the cells and tank No. 2 by means of the sump pump until oxidation is 99 per cent complete as shown by analysis. When this is accomplished, the finished sodium arsenate solution is transferred to storage tank No. 3.

Care is taken not to empty the cells completely, as it has been found that, while the admixture of arsenate solution with the arsenite lowers the current efficiency of oxidation slightly, it had the effect of decreasing the reduction of metallic arsenic on the cathodes very materially.

A suspension of 20 per cent hydrated lime in water is made in mixing tank 6 which is provided with an agitator and with live steam for heating. A known weight of lime in this suspension is allowed to flow by gravity into tank 7 or 8 and an amount of sodium arsenate solution added from tank 3 so that the weight of CaO will practically equal that of the As_2O_3 to produce a final product which will contain about 42 per cent total As_2O_3 . These tanks are provided with agitators which are kept in motion as long as there is any mixture in the tank.

Care has to be used in making this mixture. With hot solutions, the precipitate of calcium arsenate is coarse and will not bulk high enough to meet the specifications of the U. S. Department of Agriculture—80 to 100 cu.in. per pound. If the mixture is too cold, the reaction is so slow that production is diminished and the other operations delayed.

When, by analysis, the reaction is shown to have been practically completed, the sludge is pumped through a 36x36-in. 35-plate Sperry filter press, equipped for thorough washing.

The filtrate of dilute caustic soda solution is drawn off into storage tank 4. It has been found that the excess of calcium hydroxide contained in commercial calcium arsenate is not soluble in caustic soda solution even when very dilute but is, of course, slightly soluble in water to which it gives the familiar "milk of lime" appearance. When the filter press is filled the sludge pump is stopped and water forced through the cake to remove the caustic soda. As long as this wash water runs clear it is conveyed to the dilute caustic soda tank 4; as soon as it becomes milky it is conducted to the

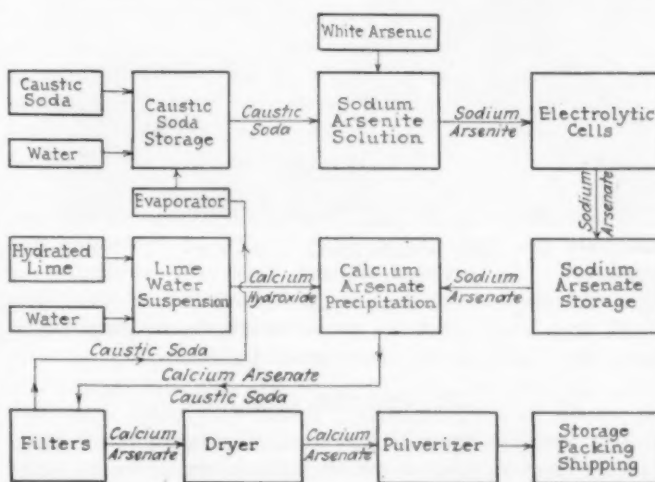


Fig. 2—Flow-sheet of Process for Electrolytic Oxidation of Arsenic and Subsequent Manufacture of Calcium Arsenate

sewer and the wash continued for about 5 minutes to insure the complete removal of caustic soda.

The filter cake is conveyed to a 5x35-ft. Louisville rotary steam drier. Some difficulty was experienced here in calcium arsenate building up on the heating coils and in dust loss from the stack. These difficulties were overcome by Mr. Nagel, the first by suspending a loose chain in the center of the drier which by continually falling freed the steam pipes of accumulation and the second by a washer for the stack gases.

The calcium arsenate usually leaves the drier as a fine powder but to insure a product which will bulk between 80 and 100 cu.in. per pound a bucket conveyor is arranged to deliver the drier discharge to a Raymond pulverizer and air separator the fan speed of which is

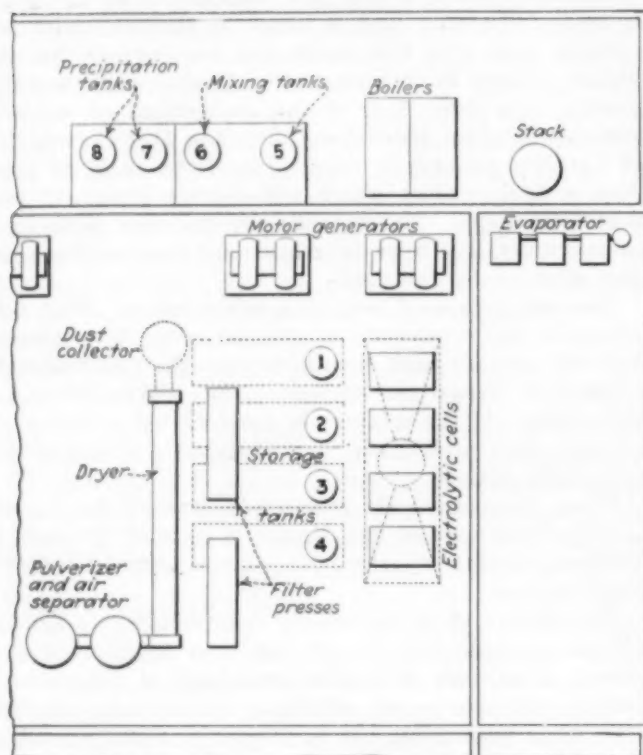


Fig. 3—Plant Layout Showing Arrangement of Equipment

adjusted so that the product discharged will come within the above specification. A small amount of lighter product is carried over and discharged in the stocking collector.

The dilute caustic soda solution is pumped to a Swenson triple-stage evaporator where it is converted by steam from the pumps into a 10 per cent solution and pumped to the caustic soda storage tank 1. The loss of caustic soda from leakage and washing amounts to about 5 per cent of the amount used per cycle of 24 hours.

When operating at full capacity of 10 tons of calcium arsenate per day, about 60,000 cu.ft. of hydrogen are produced. To prevent danger from the explosion of this, the electrolytic cells are provided with a sheet-iron hood and 24-in. vertical stack which thoroughly ventilates the cells and the area around them.

MAINTAINING QUALITY

The specifications of the U. S. Department of Agriculture provide that commercial calcium arsenate must contain at least 40 per cent total As_2O_3 of which less than 0.7 of 1 per cent shall be water soluble and that

the product, when measured after having had a current of air passed through it, shall bulk between 80 and 100 cu.in. per lb.

In addition to the analysis of raw materials and finished product, a thorough chemical control is maintained throughout the process to insure a product which will fulfill the above specifications and when reasonable care is taken in the control of the dilution and temperature of the precipitation tanks, no great difficulty has been experienced in this.

One observed quality of calcium arsenate produced by the electrolytic process as compared with that of the nitric-acid process may be worthy of mention. This material is usually dusted on the cotton plants at night so that the heavy dew which usually occurs in the South will seal the dust to the plants. When applied at this time, no difference can be noted between the sticking quality of nitric-acid or electrolytic calcium arsenate. When applied during the heat of the day when there is no dew on the plants, however, a great difference has been noted between the sticking qualities of the two products. Agitation of the plant or a few hours of wind will usually remove practically all of the nitric-acid product applied at this time while the electrolytic product has been found to adhere very much better. In one specific instance, during a dry weather spell of August, 1924, adjacent rows of cotton were dusted with the two products about noon. On the next day the nitric-acid product had apparently disappeared, while 16 days later, leaves were collected from the row dusted with electrolytic calcium arsenate which still retained a noticeable quantity of the product.

Since the novelty in this process consists in the method employed to convert arsenic trioxide to arsenic pentoxide, it would be expected that other arsenates as well as that of calcium might be manufactured also. Up to the present only calcium arsenate has been made commercially, but small scale production of lead arsenate encountered no serious difficulty. A crystallizer has recently been added to the equipment, so that sodium arsenate may be obtained likewise.

Largest Output of Fuller's Earth During 1924

The largest output of fuller's earth on record is that for 1924, as reported by the U. S. Geological Survey, working in co-operation with the state Geological Surveys in Alabama, Florida, Georgia, and Illinois. Thirteen operators in six states reported that 177,994 short tons of fuller's earth was sold in 1924, valued at \$2,632,342, or \$14.79 a ton. This output is 19 per cent greater than that of 1923, but it is more than four times that of 1914. The value of the output for 1924 was also the largest ever recorded. It was 17 per cent greater than that of 1923 and 5 per cent greater than that of 1920, the previous year having the record of greatest value. It was more than six times as large as that of 1914. Since 1920 there has been a steady decline in the average price per ton, the price in 1924 being nearly \$5 lower than that in 1920, the year of highest average.

The South continues to produce the larger part of the output. Georgia was the leading state in output and value, displacing Florida, which has occupied that position since the beginning of the industry.

Chemical Engineering in the Motion-Picture Industry

Recent Advances in the Application of Scientific Methods, with Particular Reference to Color Photography, and a Forecast of Future Developments

By F. Lester Righter

Technicolor Motion Picture Corp., Hollywood, Calif.

THE growth of the motion-picture industry has been extremely rapid, and much progress has been made in an effort to improve the product. Every phase of the industry has gone forward, in most cases, except in connection with laboratory work—in the processing



The Hollywood Laboratory of the Technicolor Motion Picture Corporation

of negative films and the production of prints. Various reasons may be advanced for the slowness in developing better and cheaper methods in the laboratory. At first the industry was a speculative one, and little or no attention was paid to the avoidance of waste. The laboratories were usually small, and little capital was available for adequate equipment. No time or money was available for research and experimental work, and no incentive was offered to men of scientific training and technical experience to enter the profession.

FILM MAKERS EMPLOY TECHNICIANS

On the other hand, great progress has been made in the manufacture of film and photographic chemicals, due to the fact that the large and old-established concerns employ technically trained men and operate large and well-equipped research laboratories. Of course, this branch of the industry has the advantage of being less affected by seasonal fluctuations. The Eastman Kodak Co., for example, employs about 200 chemists and chemical engineers at its plant at Rochester, N. Y. The work done at the research laboratory covers every phase of photography, from the purely scientific investigation to the practical application of the result. By employing such methods, the products are being improved constantly. Almost every production unit in the plant is under the supervision of a chemist or a chemical engineer.

The smaller film laboratories have combined in a few instances, and some of the larger producing organiza-

tions have established their own laboratories. This has increased competition, with the result that the demand for cheaper and speedier methods is being felt. So the motion-picture industry has turned to the technical man, as many other industries have done in the past. In the laboratory, the processing of film by rack, tank and drying drum is being displaced by newer and improved methods involving the use of automatic devices and machines. Continuous processing machines are now in use, which with three or four operators, can process as much film as 30 men could handle by the old methods.

WHERE THE ENGINEER FITS IN

Heretofore the motion-picture industry did not offer bright prospects for the chemist and the chemical engineer but, with the development of processing machines, he becomes almost indispensable. Expert technical knowledge is required for the proper manipulation of such instruments and units. The chemist is also needed for the testing of solutions used. The reclamation of the large quantities of waste film and other byproducts offers a field for the chemist and the chemical engineer that is almost untouched.

What is perhaps the most significant advance in the motion-picture industry in recent years is in connection with the commercial development of color photography. A color effect on the screen may be obtained by one of many methods: The Eastman company produces its regular positive emulsion coated on a colored base in about eight different colors. The effect of this is a general tint over the whole picture of whatever color is used in the base. Also, this film may be toned, whereby another effect is produced. Double tint and toning, and variations, have been used in place of plain black and white pictures. The hand-painted and stencil processes are slow and expensive. Many attempts have been made to put natural-color photographs on the



A Corner of the Printing Room

screen; the first result of any importance was the Kinemacolor representation of the Durbar in India. Great strides have been made since the inception of Kinemacolor, and the work of the Technicolor Motion Picture Corp., operating plants at Boston, Mass., and Hollywood, Calif., is now well known to the public by reason of the beautiful effects secured in such pictures as "The Wanderer of the Wasteland," "The Ten Commandments," "Cytherea" and many others. The use of

color has long been the desired goal of the film producer.

Photography in natural colors involves photographing on black and white negative through filters. This is ordinarily accomplished by employing two lenses, as in the case of the Kodochrome process used by the Eastman company, or through one lens in succession, with filters alternating. By the Technicolor process the picture is photographed through one lens; and by the use of a simple optical device the rays of light are split so that two identical images are produced—one through a filter recording the warm tones of the object and the other through a filter recording the cold tones. The two-color negative obtained may be treated by the additive or by the subtractive method. The additive method consists of projecting the pictures through filters separately on the screen in superimposition, so that white is obtained by the addition of, say, red and green light. The subtractive method consists of producing the colored picture on a positive film and projecting on the



Two-Color Dyeing and Drying Machine in Foreground, With Auxiliary Apparatus in the Rear

screen by the use of white light. Here the colors are produced not by the addition of colored light, but by the subtraction of white light. The subtractive principle alone is capable of commercial development at the present time, because the additive method requires new types of projectors and other apparatus involving large investment, whereas subtractive-process pictures may be used in the same projectors employed for black and white prints.

MAKING COLORED "MOVIES"

A special sensitized panchromatic film is used, which is developed as is any ordinary panchromatic stock. From this point on, however, the Technicolor process is distinctive. A special and ingenious machine has been developed that prints the picture from the red filter on one roll of thin positive, and that taken through the green filter on another roll of positive. These two rolls of thin positive are then cemented together, back to back in register. The resulting double-coated film is then developed in a continuous machine, producing a film bearing a clear gelatine relief image on each side. The composite film is then dyed—one side green and the other red; then a surfacing coat is put on by means of a continuous machine. The final product is a print in color, very slightly thicker than a black and white print and more durable. It might be expected that such

pictures would be mostly red and green but, as a matter of fact, the filters and dyes are so chosen that nearly all shades of color are represented with fair accuracy.

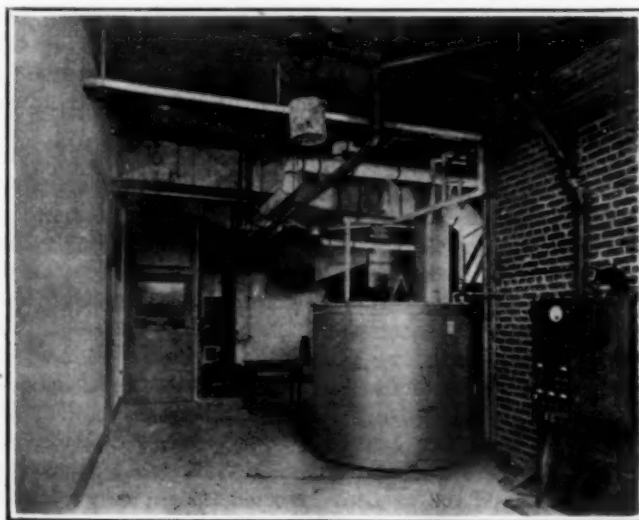
A process such as that employed by the Technicolor company requires more skill and care in operation than is necessary in the making of ordinary black and white pictures. It demands especially accurate methods of chemical control, because variations in the concentration and temperature of solution will seriously impair the quality of the product. The positive process requires the use of continuous developing machines if uniform work is expected, as well as other delicate instruments that must be operated by technical men.

It seems obvious that motion pictures in color must grow in popularity. Color is as intimately connected with nature as is animation; it may be used to express ideas, to symbolize states of emotion much more truly than mere light and shadow. Every amateur photographer has felt the inadequacy of his black and white prints as attempted reproductions of the colorful landscapes he photographed. As soon as natural-color pictures become more in evidence, the artificiality and inadequacy of black and white pictures will be realized.

OPPORTUNITIES FOR THE CHEMIST

The Eastman company and other large firms employ many chemists and chemical engineers in the manufacture of motion-picture films and supplies. The larger and more progressive black and white processing laboratories also have chemists and technical men on their staffs to operate machines and semi-automatic devices, to insure a more uniform product at a lower cost. The Technicolor company is operating plants producing natural-color pictures and employing chemists and chemical engineers to take charge of modern apparatus and to control operations.

The opportunities for the chemist are just as numerous in the motion-picture industry as in any other line of business, especially in regard to control, testing, reclamation and research. There is great need for standardization in the industry. The chemist must do what he has done in the more basic industries—get a uniform



The Air Supplied to All the Rooms in the Laboratory Is Cleaned and Conditioned as to Requisite Temperature and Humidity

and superior product at a definitely known cost. The motion-picture industry has long since been waiting for this service, and it offers a promising field for the chemist of insight and imagination.

The American Institute of Chemists

Its Scope and Methods

Standards of Education and Professional Ethics Must be Set up that Will Protect and Elevate the Profession and Insure Competent Service to the Public

By M. L. Crossley

President, American Institute of Chemists

THE development of an organization such as the American Institute of Chemists is a process of evolution. The Institute must expand to meet the growing demands upon it and its functions must be clearly defined. Unity of purpose is essential for co-operation, but unity of purpose is impossible unless the individual members of the organization understand and are in accord with the purpose and activities of the organization as a whole. The misplays in the game of life usually result from unfamiliarity with the rules of the game and subordination of team play to individual caprice. Individually we can accomplish little of lasting value, as an organization or team we can do great things for the profession of chemistry.

The scope and methods of the Institute are vital to its continued success. It is imperative that we understand its aims and appreciate its limitations. There are certain things that the Institute must do and there are other things that it must not do. It must for one thing build up an internal organization which will function smoothly and effectively with the least possible friction and loss of momentum. It is not the purpose of the Institute to duplicate or supplant the activities of other organizations serving the chemist and contributing to the advancement of the science of chemistry. It must supplement the work of other societies by doing for the profession of chemistry what has not heretofore been done, and in co-operation with all of the agencies serving chemistry be a powerful factor in the advancement of the chemical profession in the service of humanity.

The future prestige of the Institute will be indicated by the wisdom shown in the actions of the present. Its policies must be constructive and liberal, seeking ever to enhance the value of the chemist in the service of mankind. It is not enough to point out what is wrong in life, it is necessary to do something to right the wrong. Diagnosis, although valuable as a prerequisite, will not cure an ailment. To be of value it must be followed by treatment. No great forward marching movement in life has been launched at full stride. The great institutions and societies of the present are the outgrowth of small and insignificant beginnings. They are monuments to men of courage and vision. Their histories are records of continuous struggle against the destructive and indifferent elements in society. They owe what they are today to the few who dared to assume the leadership and guide them safely through the difficulties and perplexities of their youth.

This is the formative period in our history. Today

we are concerned chiefly with the formation and development of the machinery of organization. Our future growth will depend upon the structure we create now. This is a very serious undertaking. We cannot afford to make many mistakes. Progress is slow at best and we must not be discouraged, if in the face of difficulties and disappointments, we find it necessary to advance cautiously.

It is our privilege to serve as members of a very important profession and we are, therefore, obligated to improve the status of this profession. We must establish the means of differentiating between the trained and competent on one hand and the untrained and incompetent on the other. The public cannot differentiate between the qualified chemist and the unqualified, and as a result both are often discredited. It is a function of this Institute to say who is a chemist and what constitutes an adequate training for the profession of chemistry.

The Institute proposes first to establish and maintain for the profession of chemistry a standard of proficiency of such excellence as to insure competent and efficient service. This will be done principally by seeing that chemists are adequately prepared by education and experience to appreciate the problems of chemistry in relation to the needs of mankind and to discharge properly the duties and functions of the profession; by admitting to fellowship in the Institute only those of proved competency and irreproachable character, thus securing unity of purpose and action; by establishing and enforcing standards of professional conduct which merit public esteem and justify confidence in the integrity of the chemist; by doing everything possible to enhance the prestige and distinction of the profession so as to extend its influence and usefulness; and by appropriate recognition of distinguished service rendered by individual members of the profession.

TRAINING CHEMISTS

Training for the profession of chemistry must be thorough and uniform. The course of study must be strictly defined. It must include the fundamentals of chemistry, physics, and mathematics. The several branches of chemistry are so interdependent that no training is adequate which does not cover the fundamentals as a whole before specialization is permitted. In my judgment the minimum training for the profession of chemistry should be six years of study, including two years of graduate work in some particular branch of the science. The bare elementary principles can be expected in a four-year undergraduate course. A working knowledge of chemistry essential for the understanding of chemical problems and a facility in the thinking out of difficulties must come from an added

intensive training in graduate or professional schools.

A satisfactory course of study that trains men to think broadly and wisely in the application of the fundamental facts of chemistry to the solution of modern technological problems must include English, French, German, history, mathematics, physics, philosophy, psychology, economics, social science, and biology. The training in English should be sufficient to enable the chemist critically to examine his data and express his results with such brevity, clarity, and force as to carry conviction. The chemist is frequently expected to report to non-technical men and he should be trained in the art of presenting technical information in a language which is understood by the laymen without sacrificing accuracy and precision. He should be able to record his observations accurately and in order so as to be understood and evaluated by one unfamiliar with the details of the work. This kind of training in English should be the joint product of the English and chemistry departments in the university or professional school. The course should be designed to meet the special needs of technical men. It should be a requirement for the chemist.

A chemist must be able to read French and German technical literature fluently. The results of many investigations are published only in the language of the country in which the work was done and much important work is reported in French and German technical journals.

To understand the conditions of the present and be able to anticipate the demands of the future a chemist must know something about the past. We of today have no monopoly of ideas. The history of the race is a record from which all of us can learn how men similarly constituted, aspired, fought against odds, won some victories, failed to accomplish their purpose not infrequently, and made their exit, entrusting to us a heritage to be zealously guarded, enriched and passed on to posterity. We add a bit here, take away a little there, and the ball of knowledge rolls on, gaining in volume and momentum. This is particularly true in chemistry. The theories of old are the playthings of the chemists of today and will be the foundation stones in the scientific edifice of the future. No training for the profession of chemistry is adequate unless it includes the history of chemistry. The course in the history of chemistry should be designed to correlate and interpret the work of the past and to show the contribution of chemistry to world progress.

Chemistry is unintelligible without a good training in mathematics and physics. For the profession of chemistry a course should include mathematics through calculus and theoretical and practical physics. Chemistry and physics are indissolubly linked. It is difficult to say where one begins and where the other ends. There is no better study to develop power of observation than experimental physics. It cultivates an appreciation of the importance of facts and develops precision in the preparation of records. Such training is of inestimable value in the correlation of chemical data and in the interpretation of facts. Careless observation and faulty grouping of facts lead to incoherent thinking. Mathematics helps to quicken mental perception, cultivates and disciplines the imagination and aids in shaping judgment. It is indispensable to the chemist and the course of training for the profession of chemistry should include the application of mathematics in chemistry. Such a course should preferably be devel-

oped and taught by the chemistry faculty of the school.

Every professional man should have a knowledge of the fundamentals of philosophy, psychology, social science, and economics. The chemist is not an exception. His professional and business relationships are such as to call for special extension and elaboration of the principles of ethics and logic. His success is often measured more by his ability to deal with men than by his knowledge of chemistry. The training in psychology and social science should help him to understand the conditions surrounding his work and make him a constructive force in society. The chemist must also have a better training in the fundamentals of economics and their application to business. This is particularly necessary for the industrial and consulting chemist. He must think in terms of costs, markets and profits. It is essential that he be trained to analyze and evaluate the elements contributing to successful business. The research chemist can also profit by such a training. Less misdirected effort, fewer false starts, and more gratifying results should be expected. Following the scent of truth, simply for the sake of experiencing the pleasure of momentarily possessing it, is a fascinating and laudable pursuit, but there are marked differences in the value of truths and it is only common sense to go after that most worth while. No sane hunter will waste his ammunition on a sparrow when he has a chance to get a partridge.

A general course in biology should be developed for the professional chemist. This should give him a composite picture of the structure and functions of his body and an appreciation of the influence of environment on health and happiness. Any further training in biology should be given in connection with the special work of the graduate or professional school.

The best education for a chemist is that which fits him best to understand the problems of his environment; to appreciate most thoroughly human efforts and limitations and to enjoy the privileges of unselfish services, in short that which gives him the fullest acquaintanceship with life.

There are definite courses of training for the chemical engineer and it is equally important that the training for the profession of chemistry should not be left to chance. A man should know before he begins his study for the profession of chemistry what course of training is necessary. The basic training should be the same for all chemists and special training should be selected to meet the needs of the individual. The Institute must formulate a course of study to meet its membership requirements and then co-operate with the colleges, universities and professional schools to obtain the desired results. The committee of the Institute on professional education is now studying this problem and we look forward to their report with interest and pleasure.

If the Institute is to be a powerful factor in the advancement of the welfare of the chemist it must be truly representative of the American chemist. It must include in its ranks all the qualified members of the profession, and no man unqualified for membership in the Institute should be considered as a chemist. When our aims and methods are clearly understood all trained chemists will unite with us in the effort to uphold the status of the profession. We have no selfish purpose. Our goal is efficient service through co-operative effort. We shall expect our membership to increase considerably during the coming year and it will if each of us

does his part in bringing to the attention of his friends the fact that the Institute exists to serve the profession of chemistry as a whole and that the Institute is not dominated by any individual or group of individuals.

We are not seeking membership simply to increase our enrollment, we are desirous of having the American chemical profession act as a unit for the future advancement of the profession of chemistry and the greater opportunities for service by the individual members of the profession. We confidently look forward to the time when the only chemists outside the Institute will be those who do not measure up to the standards for admission. The Institute members in college and university faculties and the local chapters of the Institute should serve as the outposts for the membership committee. I would also like to see the professors take the lead in organizing the junior membership. This is where the process of selection of chemists begins, and with a prescribed course of training for chemists the unfit will be largely weeded out in the process of training. Junior membership in the Institute could be made to serve as an incentive to better training. Fellowship in the Institute should in time be a promotion from the rank of associate and come as a distinction. The ranks of the associate will be replenished from the junior membership. The committee on membership will give careful consideration to this problem and will welcome your suggestions.

The code of ethics has been carefully considered by the Ethics Committee and tentative recommendations for changes suggested. The revised code will be submitted for your consideration next fall. To formulate standards of professional conduct for the profession of chemistry is extremely difficult. Principles of ethics governing the relations between the chemist and his client are quite different from those applying to the professions of law and medicine. Facts are the chief concern of the chemist and his interpretation of such facts must be consistent with well established principles, even though prejudicial to his client's case. What is apparently ethical for the lawyer is unethical for the chemist. The problem is very complex and calls for careful study before any formulation of policy is possible.

There is one activity in which the Institute can afford to take part, even at the risk of duplicating the work of other societies. It should provide some adequate and appropriate recognition of distinguished service rendered by individual members of the chemical profession. I would like to see the Institute take measures to establish three medals to be awarded annually for distinguished service by chemists serving in the fields of teaching, government service and industry, each medal to be named in honor of some American chemist, who by common consent, has contributed much as a leader in one of the three fields and in whose honor no medal has yet been named.

A second important function of the Institute is to do whatever it can to aid in the education of the public to a better appreciation of the contribution of the chemist to world progress. Modern life is dependent on chemistry for many of its necessities and luxuries. The triumphs of chemical knowledge and technical skill that made these possible are for the most part unknown to the public. It is our obligation to see that some means is provided for establishing a more direct contact between the chemist and the public he serves. The service of the physician is appreciated because it is direct. The chemist enters the sickroom with the

physician but he is invisible and his presence is unsuspected by the patient. The pain is eased and the vital functions again restored to normality by the drug created by the chemist and administered by the physician. The patient, however, recognizes only the physician in relieving his suffering. Modern medicine is applied chemistry. The chemist has an obligation to society to make known the part played by chemistry in the relief of suffering and in the conservation of life. There are three ways by which such information can be presented to the public: Popular lectures before the several lay societies, radio lectures, and by means of a journal of popular chemistry. There is not a single journal presenting the story of chemistry in a language which can be understood by the layman. In my judgment this offers a real opportunity for the institute, if some means can be found to finance such a journal. It is quite possible that a satisfactory arrangement can be made with some publishing house which would assume the responsibility for the venture.

It is also a function of the Institute to help to improve the economic status of the profession of chemistry. This can be done by promoting public recognition of the service rendered by the chemist and its value to mankind; by working out an efficient system of placing the right man in the right job; by co-operating with employers of chemists, universities, industries, government bureaus, and public and private laboratories to secure a more satisfactory differentiation between chemists and laboratory helpers; to discourage the system of entrusting important chemical work to untrained incompetent men; by promoting a higher evaluation of the services of the chemists; by fearlessly exposing incompetency and fraud whenever and wherever found; by always being on the alert for state and federal legislation effecting the chemical profession; and by helping to make such legislation constructive.

The several committees of the Institute have served with devotion and efficiency during the past year. The Committee on Classification has studied the problem very carefully and recommended to the council that it deems it unwise at present to undertake any classification other than that now provided for in the constitution. It does feel, however, that the Institute should classify the several schools offering courses for the Bachelor of Science degree in chemistry to meet the requirements of the Institute. The Legal Committee has made a critical study of several questions affecting the organizations and policies of the Institute and formulated certain principles to guide the profession in business relations. It is hoped that the membership will find the information useful. The question of incorporation has been given careful consideration and the necessary change in the form of organization offered as an amendment to the constitution at this meeting. The Institute is deeply indebted to all of the committees for their unselfish devotion and loyal service.

One of the important problems which must receive consideration during the coming year is a study of some practical system by which the Institute can place chemists. The Institute must find a way to improve the circumstances surrounding the employment of chemists. We should establish a system that will include the complete record of every member. This information must be sufficient to enable the Institute, in time, to select the man best qualified for service in a particular field. The Institute should be the medium between the chemist and the employer.



Carnation Condensery at Gustine, Calif.

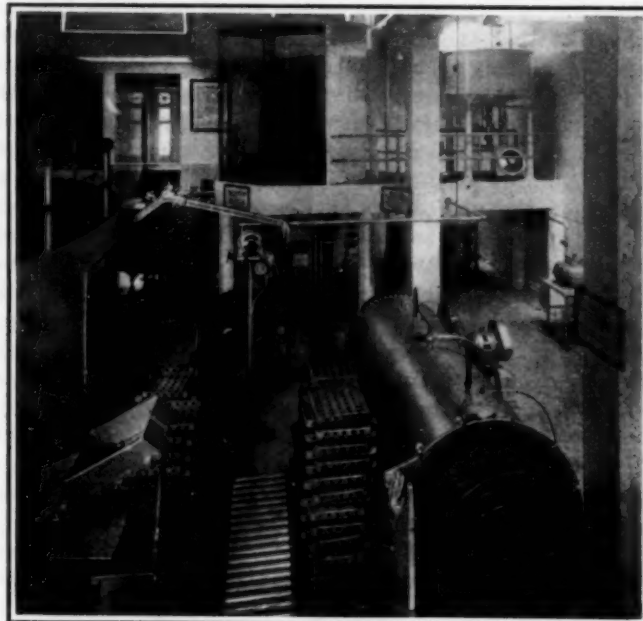
Science and Engineering Applied to Milk Industry

**Chemical Control, Strict Standards of Manufacture
and Utilization of Modern Equipment Have
Made Condensed Milk a Reliable and
Economical Food**

"NOTHING added; nothing taken out except water"—this epitomizes operations at a Carnation milk condensery; but the slogan conveys no inkling of the intensive application of science to industry that has played so important a part in the perfection of processing, in the production of a concentrated food of the highest order of nutritive value and added "keeping" powers, and in the avoidance of the waste, in freighting water, that characterizes the marketing of ordinary milk.

Raw milk destined to be transformed into a condensed product must conform to Carnation standards in regard to butter fat and casein content; standards that are more drastic than those imposed by state or federal laws. The chemist in charge tests the raw milk from each purveyor five times each week, not only for fat and casein, but also for sediment and acidity. Acidity is not neutralized in Carnation plants; the milk is condemned and discarded. As soon as all requirements are met, however, the raw product after weighing and screening, is stored in glass-lined tanks. From these it goes as required to heaters, thence to copper vacuum pans, for the evaporation of the bulk of the water. The inspissated product then passes through a machine known as a homogenizer, which breaks up the globules of butter fat into particles of colloidal magnitude. This change is effected by forcing the condensed milk between the faces of grooved disks, placed so close together that a pressure of 2,000 lb. is developed. After homogenization, the milk passes through a cooler of coiled pipe, over which ice-cold brine circulates, whereby temperature is reduced from about 140 to 40 deg. F. It then passes to glass-lined tanks, from which samples are taken for analysis, to check the composition of the product and thereby to insure strict standardization.

Canning and sealing are done by machine. A rigid inspection for leaks is then made by immersing the trays of cans under water that has been warmed to a temperature that will insure internal expansion. Sterilization is effected in a revolving retort, after which the cans are stored in a room for 72 hr. at a temperature most favorable for the multiplication of bacteria if any be present. Each can is then inspected. Milk that reaches the retailer after passing these rigid tests may be considered as pure as accumulated experience, technical control, and human ingenuity and care can make it. Frequent analysis, the use of equip-



Interior of a Condensery, Showing Glass-Lined Storage Tanks in Distance, Cooling Coils on Platform and Sterilizer in Foreground

ment that can be cleansed at daily intervals, and large-scale production are jointly responsible for the development of an industry of rapidly increasing proportions, one that bids fair to assume major importance in the utilization of dairy products when the prejudice that exists in some quarters against condensed milk is overcome by fair trial and education. The Carnation condenseries throughout the United States, operated on identical plans in so far as processing and technical control are concerned, produce over one million cans per day.

Refining Natural Salt Cake

**How a Product of Excellent Quality Is Won From a
California Desert by the Pacific Distributing
Corporation**

By Leroy A. Palmer

THE Pacific Distributing Corporation of San Francisco is marketing salt-cake of excellent quality from a natural deposit in the California desert. The deposit is located at Soda Lake in the Carrizo Plain. Soda Lake is a mud deposit having an alkaline crust several inches thick. This deposit is at the bottom of a large natural basin that has no drainage outlet. It is adjacent to the Kern County oil fields and the rocks of the surrounding hills are the marine sediments characteristic of the region. It is to be expected that these rocks would contain a considerable amount of soluble salts from the ancient seas aside from those which may enter into the composition of the rock-forming minerals themselves. The wash from the hills surrounding the basin, carrying in solution salts from the rocks and soil, finds its way from all sides to the playa. The climate is semi-arid to arid, and evaporation is high so that the water in which the salts are dissolved is quickly evaporated and the latter are precipitated as an efflorescent crust.

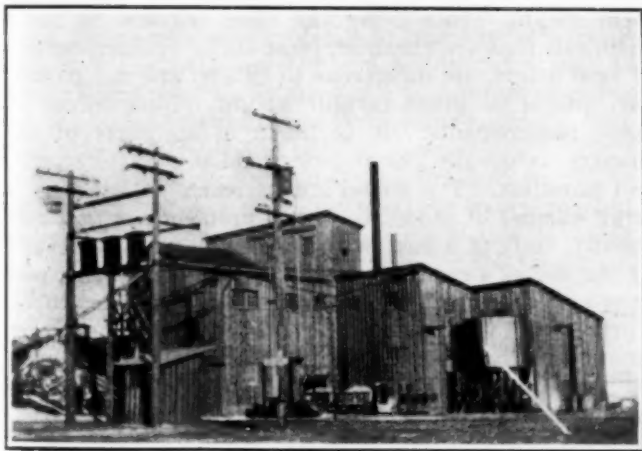
A brief description of the deposit is given by H. S. Gale, U. S. G. S. Bulletin No. 540, in which he submits the following analysis:

	Per Cent
Insoluble	0.40
Al ₂ O ₃	0.04
MgO	1.66
CaO	0.45
Na ₂ O	40.50
K ₂ O	0.28
H ₂ O	3.65
CO ₂	None
SO ₃	46.12
Cl.	9.27
	<hr/>
	102.37
Less oxygen.....	2.09
	<hr/>
	100.28

This compares closely with the following average of several analyses in the company's laboratory, given in less detail:

	Per Cent
Na ₂ SO ₄	70
NaCl	14-15
MgSO ₄	7-8
H ₂ O	6
Insoluble	2-3

Refining the crude salt is a simple process. Harvest-

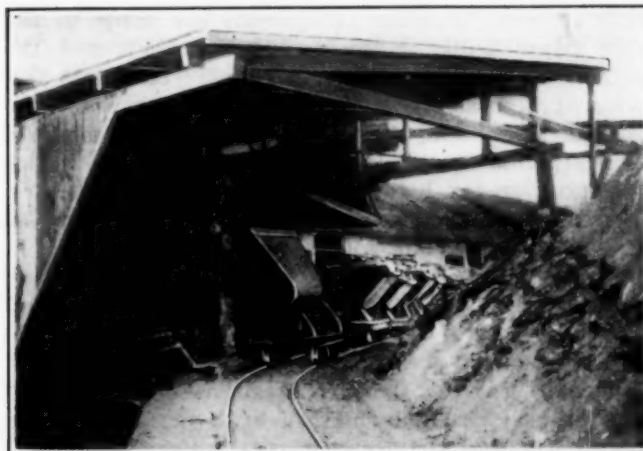


View of the Mill at Soda Lake, Carrizo Plain, California

ing is done by simply breaking the surface crust and forking the pieces into side-dump cars. These are hauled in trains to the mill, which is on the shore of the "lake." At the plant, the cars are dumped to the boot of a chain scraper, which elevates the salt 18 ft. and dumps it to a Jeffrey pulverizer. The cake is crushed to 10-mesh and discharged to classifiers where the first step in the purification takes place.

There are 3 duplex classifiers, set in series. The salts are washed in the classifiers by a current of cold water, which removes the mud and the greater part of the sodium chloride with very little solution of the sulphate. The chloride is washed out with the mud and a small amount of sulphate goes into solution when fresh water is used but this will be corrected by the use of brine pumped from beneath the mud and salt crust of the lake.

The classifier product is elevated 35 ft. to an agitator that works on the principle of a log washer, consisting of a series of propeller blades mounted on a shaft 20 ft. long. Water at a temperature in excess of 90 deg. F. is used in the agitator, this temperature being necessary to prevent the formation of Glauber's salt, which would form if a lower temperature was used. The



These Dump Cars Deliver the Salt from the Lake to a Conveyor Which Feeds the Pulverizer

agitator keeps the sulphate in suspension while the remaining chloride and magnesium salts go into solution and are washed away. There is also an unavoidable loss of a portion of the sulphate.

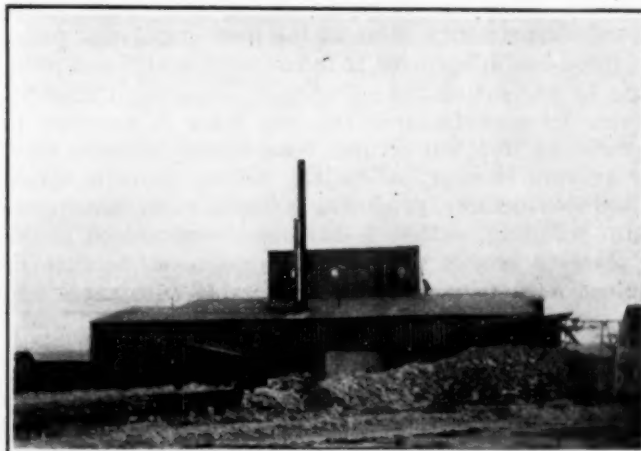
When the agitator has accumulated a charge of 1,400 lb., it is discharged by a trap valve to one of three Tolhurst centrifuges. The charge is washed 40 sec. with hot water when first started and it is then whizzed 10 min. at 750 r.p.m. The solution from the centrifuges is pumped to the classifiers for wash water as it contains some chloride, and less sulphate is lost by washing with a solution of this character than with fresh water.

The centrifuge discharges through a bottom door to a worm conveyor to an elevator which raises this, the final product, to the shipping bins. The analysis of this product is:

	Per Cent
Na ₂ SO ₄	96.0
MgSO ₄	1.5
NaCl	0.5
Insoluble	0.4
H ₂ O	1.6

The plant handles 100 tons of crude salt per 24 hours and produces 60 tons of salt cake. For this output 14 men are employed on the lake, 6 on the railroad and 8 in the mill. Blacksmiths, clerical help, cooks, etc., bring the total force up to 43, including the superintendent. One hundred and forty horsepower is consumed.

Because this is a natural substance instead of a by-product, it is free from both iron and acid, besides



View of the Soda Lake Deposit with the Mill in the Background

being in loose crystals. Shipments are made to the kraft paper mills of Wisconsin, Minnesota and the southern belt of Louisiana and Texas. The glass factories of Kansas, Arkansas and Oklahoma are large users in the middle West and shipments are made to various points on the Pacific Coast from Los Angeles to Vancouver for both glass and paper manufacture. The kraft paper industry is the largest consumer of natural sodium sulphate and both industries are in their infancy. The greater part of the mill construction for this type of paper has taken place since 1915, and the present size of this industry is indicative of future possibilities. At present, freight rates are such that the market for the California salt cake is restricted by a boundary roughly marked by a north-south line through Chicago and New Orleans, generally referred to in the trade as the Mississippi River Boundary.

For assistance in collecting and preparing this article I am indebted to Harry G. Frank, general manager, Jack Kaufman, sales manager and Philip S. Williams, general superintendent of the Pacific Distributing Corporation.

Use of Lime in Preventing Stream Pollution

Experience Shows Lime to Be Effective in Treating Wastes from Rubber, Leather, Textile, Paper, Sugar and Food Products Plants

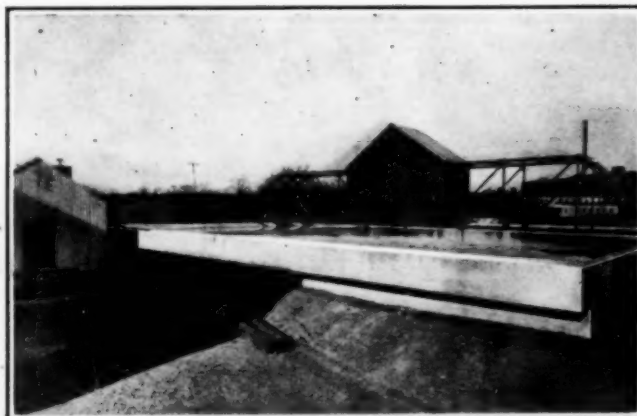
By E. B. Besselièvre

Sanitary Engineering Division, The Dorr Company, Engineers

CLEAN, palatable water is a necessity of man for his normal existence and for his domestic animals. Abundant water is necessary to the productivity of most manufacturing plants. A large proportion of the water consumed by man and industry is returned to natural streams, but in a polluted condition; and the man or industry downstream, receives this polluted water. If discomfort, disease, and damage are to be prevented, measures must be taken to prevent this pollution.

Filtration plants installed by the water user will protect him but will also place upon him the burden of treatment of another's waste. Natural laws of equity say that his burden should not be placed upon the innocent water consumer, but that the one who pollutes the water should do his part to protect his neighbor. In this country this principle has not always been enforced, but now all of the 48 states of the union have active health departments. One of the most important duties of these health agencies is to conserve health and property by preventing the pollution of streams. Concerted action by manufacturer and the State is required to accomplish this, but oftentimes considerable pressure must be brought to bear, before any definite move is taken. The manufacturer, producing a liquid waste which contains polluting matter, is naturally reluctant to install a plant to render these wastes innocuous, because he cannot hope to recover any profitable substances and his expense of treatment will be a daily financial load.

Most industrial wastes can be rendered harmless by modern methods of treatment, but some of the more complex combinations need careful study to devise the most economical form of treatment. The polluting elements in industrial wastes are either organic, chemical, or mineral, and cause trouble by rendering the



Dorr Thickener at a Large Industrial Plant for the Treatment of Glue Waste

water distasteful or harmful to the human system, or to the machinery and processes of the manufacturer. As profitable operation of an industrial waste treatment plant can seldom be hoped for, it should be the object of every engineer engaged, to investigate a problem to determine the cheapest, most practical way to solve it.

Chemical treatment is, in most cases, necessary to produce water-white, neutral effluents from waste treatment plants. This being the case, the use of those chemicals that are cheapest, most easily procurable, and of local origin, not dangerous to handle, and not poisonous, should be given careful weight. Lime meets all these requirements. It is found in all parts of the country, is usually low in price, and is easy to handle, and harmless. The writer's experience, in handling a large number of industrial waste problems, is that frequently, tests of a particular waste will produce results by the use of a small amount of a certain chemical, perhaps a patented article procurable only from one source. Further test will frequently show that by using larger amounts of another, or perhaps two other chemicals, the result will be the same and the cost less. Lime usually forms the one found cheapest or is in the combination.

The writer's firm, in a large number of investigations of industrial wastes, extending over 4 years, has found over 40 cases in which lime alone, or used in combination with another chemical, procured the desired results. Where acidity is to be removed, or solids precipitated, lime is usually the ideal agent. After formation of floc by other agents, lime precipitates this floc. The sludge formed by lime precipitation is usually inodorous and may be filtered or otherwise dewatered to a state where it can be readily disposed of.

In investigating the industrial waste problems presented to us, we have found the following industries to have wastes which respond to lime treatment: Rubber reclaiming plants, tanneries, textile mills, including bleacheries, dye houses, wool scouring plants, finishing works, piece-dye works, etc., distilleries, laundries, coconut products, strawboard, paper mills, gun wadding, roofing paper, banana oil, gas house, creameries, canneries, packing houses, steel and iron mills, sugar factories, etc.

Textile mills produce usually highly-colored, highly-alkaline or acid wastes. Lime serves a great purpose, here, in precipitation and neutralization, helping to render the sludge easier to handle, by rendering the organic solids stable.

Piece-dye works wastes and woolen-mill wastes are the most difficult textile wastes to treat, the former

because of the constant change in character and color, and the latter on account of the wool grease itself.

Tannery wastes contain finely-divided and slow-settling solids, without assistance, and also color and tannic acid. Lime is an ideal aid in treating these wastes, to precipitate and neutralize.

Creamery wastes contain a large amount of highly putrescible solids and casein. By adding ferrous sulphate and lime, the solids and casein are coagulated and precipitated, and a clear, fairly stable effluent is produced. Several plants of this type have been in successful operation for several years.

Cannery wastes, from vegetable canneries in particular, contain large volumes of solids and are readily putrescible. Lime acts as a precipitant and also as a disinfectant, preventing the decomposition of the solids. Plants treating pea and tomato wastes, by the use of lime and ferrous sulphate, are in successful operation.

Coal-mine wastes are usually highly acid and where these discharge into clear streams, the wastes may be neutralized readily by the use of lime.

Wastes from steel and iron mills, known as "pickling liquors" are highly acid, and lime again acts as the neutralizer.

Lime usually produces a voluminous sludge and the disposal of this is a problem in itself. The wetter this sludge, the greater is its volume, so that any unit which will reduce the moisture will be a decided advantage to plants using lime. Using lime as a precipitant requires the use of a sedimentation tank to allow sufficient time for the deposition of the precipitating solids. If this sludge is allowed to accumulate on the bottom of the tank, it will, after a short time, be necessary to shut the tank down and clean it out. While this is being done, another tank must be available, or the treatment stopped.

To enable continuous treatment, to eliminate the need for duplicate tanks, to eliminate manual cleaning of sedimentation units, and to assure uniform results in clarification, by keeping the volume of the tank always the same, a unit known as the Dorr clarifier has been in successful operation for several years.

It is very essential, in chemical precipitation plants, to procure an adequate and complete mixture of the chemical with the waste to be treated, and it therefore has been necessary to devise special mixing devices for use as the first units in plants of this type. This mixing device is a combination of an agitator, providing baffled entrance to the tank, the chemicals being dropped into the waste behind this baffle and the waste then circulated and agitated violently before it passes out at the opposite side of the tank. This violent mixing procures full use of the chemical and assures the maximum result in clarification.

The feeding of lime to the waste to be treated is important. The writer believes the use of powdered, hydrated lime is the easiest and most practical way, as the difficulties encountered are less and manual attention required is less. There are several good dry feed units on the market, but the writer's experience is that the difficulty most encountered, in feeding dry lime, is not with the actual feeding mechanism, but is in the hopper. Lime, when any moisture is present, tends to form an arch at the mouth of the feeder, and when this happens, no lime gets to the feeding device. Feeder manufacturers should give this point careful study and should devise means to prevent arching in the hopper.

Of all available chemicals that have a practical value

in the treatment of industrial wastes, and at the same time possess the elements of economy, easy procurement, and easy handling, lime stands preëminent, and no one investigating such problems can neglect its possibilities.

References to Recent Work on Nitrocellulose Lacquers

By F. M. Crawford

Department of Research Information,
Commercial Solvents Corporation

PYROXYLIN lacquer comprises varying proportions of the following materials: nitrocellulose, varying amounts of a number of high and low boiling solvents, gums, and plasticizers. Under each classification of lacquer raw materials, a number of grades of unit material are known. For example, at least 15 different kinds of nitrocellulose are available, literally hundreds of solvent materials have been proposed and at least 20 different solvents are in widespread use. Obviously, then, with so many variables in composition, it is exceedingly difficult for even the experienced worker to prophesy accurately the nature of the lacquer film that will be obtained in any particular case. Likewise, few tests have as yet been devised, that are both accurate and reliable.

Many of our present methods of testing lacquers and lacquer materials have been derived from similar tests used in the paint and varnish industries. Often these tests are inaccurate and give inconclusive results when applied to lacquers, but when properly modified in the light of more advanced knowledge of the specific nature of lacquers, they lead to methods and results which are of practical value.

The Relation of the Chemical Engineer to the Manufacture and Application of Automobile Finishes, C. D. Holley. *Chem. & Met.*, 1921, vol. 25, pp. 873-6.

The Story of Butanol, C. L. Gabriel. *Paint, Oil and Chem. Rev.*, vol. 18, No. 6.

Standard Automobile Finishes, L. V. Pulsifer. *Paint, Oil and Chem. Rev.*, 1924, vol. 77, No. 26, pp. 10-11.

Nitrocellulose Automobile Finishes, L. V. Pulsifer. *J. Soc. Auto. Eng.*, 1924, vol. 15, pp. 474-5.

Automobile Body Finish, L. V. Pulsifer. *Automobile Trimmer and Painter*, 1924, vol. 3, No. 6, pp. 49-50.

Increasing Popularity of New Finish, W. Webb. *Automobile Trimmer and Painter*, 1924, vol. 3, No. 12, p. 59.

Automobile Body Finishes, H. C. Mougey. *Paint, Oil and Chem. Rev.*, 1924, vol. 78, No. 4, pp. 10-12.

More Durable Car Finishes Are Making their Appearance, H. C. Mougey. *Auto. Ind.*, 1924, vol. 50, pp. 777-9.

Refinishing of Automobile Bodies, L. V. Pulsifer and O. H. Briggs. *J. Soc. Auto. Eng.*, 1924, vol. 14, p. 571.

Lacquer and Lacquering, H. Zeller. *Metal Ind.*, 1921, vol. 21, pp. 444-5.

Address Before St. Louis Production Club, A. Orr. *American Paint Journal*, 1924, vol. 8, No. 50.

Another Varnish Maker Enters Field of Pyroxylin Automobile Finishes, Anon. *Auto. Ind.*, Aug. 14, 1924.

All Seven Coats of Pyroxylin Finish Applied in Two Days, H. Chase. *Auto. Ind.*, 1924, vol. 51, pp. 254-5.

- Exceptional Durability Is Claimed for New Body Finish, H. A. Chase. *Auto. Ind.*, 1923, vol. 49, pp. 158-9.
- Causes of Paint Failures, H. C. Mougey. *J. Soc. Auto. Eng.*, 1924, vol. 14, pp. 479-80.
- Body Refinishing for Speed and Durability, E. M. Flaherty. *Bus Transportation*, 1924, vol. 3, p. 186.
- Pyroxylin Enamels, E. M. Flaherty. *Automobile Trimmer and Painter*, 1924, vol. 3, No. 6, p. 55.
- Revolutionary Painting Methods, R. C. Williams and R. S. Rogers. *J. Soc. Auto. Eng.*, 1924, vol. 14, pp. 90-3.
- Clouding, J. F. Nonamaker. *Brass World and Platers' Guide*, 1922, vol. 18, p. 66.
- Labor Costs Halved by Use of Duco in Finishing Oakland Bodies, W. L. Carver. *Auto. Ind.*, 1923, vol. 49, pp. 524-6.
- New Lacquer Finishes for Automobile Bodies, A. Hall. *Automobile Trimmer and Painter*, 1924, vol. 3, pp. 27-31.
- Discussion of Two Essentials Necessary in Building Up an Automobile Finish, J. L. Gates. *Automobile Trimmer and Painter*, vol. 3, No. 3, p. 52.
- Treatise on Lacquer Finishing, C. Ludwig. *Automobile Trimmer and Painter*, vol. 3, No. 11, p. 52.
- Lacquer Finishing—Its Faults and Corrections, C. Ludwig. *Automobile Trimmer and Painter*, Jan., 1925, p. 61.
- Pyroxylin Finishes, Hillrick. *Motor Vehicle Monthly*, Nov., 1924, p. 34.
- Actual Experience with Pyroxylin Enamels, T. W. Price. *Automobile Trimmer and Painter*, 1924, vol. 3, No. 10, p. 30.
- Lacquer Finish Fast Increasing in Favor, K. W. Lansing. *Automobile Trimmer and Painter*, 1924, vol. 3, No. 8, pp. 63-69.
- Facts About Wood Lacquers, W. G. Schmidt. *Industrial Finishing*, Nov. 1924, p. 58.
- Some Causes of an Unsatisfactory Lacquered Finish, J. K. Cooper. *Industrial Finishing*, Nov., 1924, p. 57.
- Removing Finish to Prepare Surface for Lacquer, J. K. Cooper. *Industrial Finishing*, Dec., 1924, p. 18.
- What Wood Lacquer Really Is, R. L. Masterson. *Industrial Finishing*, Jan., 1925, p. 29.
- Pyroxylin Enamels—Important Suggestions Regarding Their Use, A. W. Moody. *Automobile Trimmer and Painter*, Jan., 1925, p. 58.
- The Glidden Lacqueroid System of Motor Car Finishes, M. J. Pierce. *Automobile Trimmer and Painter*, Jan., 1925, p. 72.
- Automobile Body Finish, Anon. *Autobody*, July, 1924.
- Application of Duco, Anon. *Motor World*, Nov. 13, 1924, p. 26.
- A Glossy Pyroxylin Finish, Anon. *Auto. Ind.*, Sept. 18, 1924, p. 526.
- Automobile Body Finishes, Anon. *Automobile Trimmer and Painter*, June, 1924, p. 49.
- New Development in More Durable Finishes, Anon. *Auto. Ind.*, May 1, 1924, p. 978.
- Glidden Company Develops Lacqueroid System of Finishing, Anon. *Auto. Ind.*, vol. 52, No. 1, p. 12.
- Development in the Use of Air Drying Enamel, Anon. *Automobile Trimmer and Painter*, 1924, vol. 3, No. 3, p. 53-6.
- Defects of Paints and Varnishes, W. J. Oberbeck. *Paint, Oil and Chem. Rev.*, vol. 78, No. 7, p. 10.
- Zapon Pyroxylin Finishes Now Ready for Use in Body Production, Anon. *Auto. Ind.*, 1924, vol. 51, p. 121.
- Coach and Automobile Finishes, E. Perry. *Oil, Paint and Drug Reporter*, 1924, vol. 106, p. 20.
- Egyptian Lacquer Develops New Nitrocellulose Automobile Finish, H. Chase. *Auto. Ind.*, 1924, vol. 50, pp. 828-9.
- Finishing and Refinishing Approaching High Engineering Standard, H. Chase. *Auto. Ind.*, 1924, vol. 50, pp. 1134-7.
- Further Developments Made in Celluloid Finishings, Anon. *Auto. Ind.*, 1924, vol. 51, p. 194.
- Pyroxylin Enamels Finding Favor, E. M. Flaherty. *J. Soc. Auto. Eng.*, 1924, vol. 14, pp. 352-3.
- What Basic Materials Go Into Automobile Finishes? Anon. *Auto. Ind.*, 1924, vol. 51, pp. 34-8.
- Demand for Better Body Finishes is Being Met, Anon. *Auto. Ind.*, 1924, vol. 50, pp. 1264-8.
- Demand for More Durable Finishes Stimulates New Developments, Anon. *Auto. Ind.*, 1924, vol. 50, pp. 978-81.
- Final Coat of Latest Pyroxylin Finish Gives Gloss Without Polishing, Anon. *Auto. Ind.*, 1924, vol. 51, p. 526.
- Manufacture of Rubber and Pyroxylin Coated Fabrics Differs Widely, Anon. *Auto. Ind.*, 1923, vol. 49, pp. 794-7.
- Duco Finish, New duPont Product, Anon. *Auto. Ind.*, 1924, vol. 48, p. 1125.
- Lacquers, Japans, and Enamels, Anon. *Brass World and Platers' Guide*, 1922, vol. 18, p. 66.
- How Qualities of Coated Automobile Fabrics are Determined, E. B. Bengner and N. M. Nickowitz. *Auto. Ind.*, 1923, vol. 49, pp. 1262-6; 1306-8.
- Accelerated Weathering of Paints on Wood and Metal Surfaces, H. A. Nelson. *A. S. T. M.*, 1922, vol. 22, part II.
- The Hiding Power of White Pigments and Paints, A. H. Pfund. *Research Bulletin*, The New Jersey Zinc Company.
- Some Physical Properties of Paint and Varnish Films, H. A. Nelson and G. W. Rundle. *Research Bulletin*, The New Jersey Zinc Company.
- Zinc as a Paint Pigment, W. H. Hendricks. *Research Bulletin*, The New Jersey Zinc Company.
- Cyclohexanol—The Newest Solvent, J. F. Schuster. *Drug and Chemical Markets*, vol. 16, No. 8, p. 565.
- The Gelatinization of Nitrocellulose Solution, A. Szegvari. *Kolloid Zeit.* 1924, vol. 34, pp. 34-7.
- Modern Automobile Finishes, H. C. Mougey. *Industrial Finishing*, March, 1925, p. 16.
- Overcoming Spray Troubles, L. J. Goudin. *Industrial Finishing*, March, 1925, p. 36.
- Pyroxylin Enamels, A. W. Moody. *Automobile Trimmer and Painter*, 1925, vol. 4, No. 3, p. 41.
- Aging Tests of Varnish Films Accelerated by New Apparatus, Anon. *Auto. Ind.*, March, 1925, p. 546.
- Latest Lacquer Finish is Termed Berryloid, Anon. *Auto. Ind.*, 1925, vol. 52, No. 7, p. 264.
- Eastman Kodak to Market New Automobile Paint, Anon. *Auto. Ind.*, vol. 52, No. 8, p. 323.
- Cyclohexanol—As a Plasticizer, F. J. Schuster. *Drug & Chem. Markets*, vol. 16, No. 8, p. 566.
- Using Duco Rough Stuff, Anon. *Auto Trimmer and Painter*, 1925, vol. 4, No. 2, p. 67.
- Information Concerning Pyroxylin Enamel System, Anon. *Automobile Trimmer and Painter*, 1925, vol. 4, No. 2, p. 65.
- Solvent and Non-solvent Liquids, R. L. Masterson. *Industrial Finishing*, Jan., 1925, p. 30.
- Nitrocellulose Automobile Finishes, L. V. Pulsifer. *Automobile Trimmer and Painter*, vol. 4, No. 2, p. 33.
- The Origin of Lacquer, L. W. Carlson and D. T. Tight. *Automobile Trimmer and Painter*, vol. 4, No. 2, p. 61.

Colloids in Industrial Operations

New Catalysts, Fertilizer Retention by Soils and Pigment Properties Were Considered At Colloid Symposium

The third annual Colloid Symposium, held at the University of Minnesota on June 17, 18, and 19, was not merely an academic gathering; many of the delegates and three of the speakers were from industrial concerns. A survey of the register shows that out of 365 delegates, 69 were from industries. Some of the lines of industry represented included the manufacture of paint and varnish, sugar, glass, rubber, aluminum, storage batteries, ink, asphalt, petroleum, soap, chemicals, photography, rayon, artificial leather, starch, glue, coal-tar products, synthetic plastics, and linseed oil. Besides these industrialists there were consulting chemists, bacteriologists and chemists from hygienic laboratories and medical research institutes, and city and state chemists. This was a most gratifying showing to colloid workers, for it indicated that colloid chemistry is not merely an academic plaything, but that it is of practical utility. It "has arrived."

ALTHOUGH no new concepts of a fundamental nature were presented at the Colloid Symposium practically every phase of theoretical and applied colloid chemistry and physics was touched upon in the program, including soils, catalysts, paint pigments, soaps, emulsions, orientation of molecules, electrokinetic potentials, photographic sensitizing substances, aluminum flocs in water purification, plasticity of rubber, and motion pictures of the Brownian movement of colloidal particles in the ultramicroscope.

PARTICLE SIZE OF PAINT PIGMENTS

An accurate knowledge of the percentage distribution of the various sizes of particles of colloidal material is rapidly becoming one of the fundamental requirements in the control and improvement of the product of the paint, dyestuff, rubber and ceramic industries. This was brought out in relation to the properties of paint pigments in a paper by J. B. Nichols of the University of Wisconsin and Henriette Liebe of the Acme White Lead & Color Works.

If one studies the effect of varying the size of particle of paint pigment on its properties, one at once discovers that obscuring power, hiding power, oil absorption capacity, permeability, consistency and even the rate of disintegration of the paint film by sunlight are altered. Of course, the degree of subdivision is not the only factor, but it is an important contributing factor. Of the methods at present used in the determination of particle size probably the most satisfactory one is that of studying a sedimenting system and obtaining the distribution relation by the application of Stokes' law.

Sedimentation under gravity is time consuming, so by substituting centrifugal force for gravitational force one may determine the distribution most conveniently. A special centrifuge permits the observation or photographing of the material as it is being whirled out to the periphery. The concentration gradient from the inner to the outer end of the tube is measured; and

by application of a modified form of Stokes' law, the distribution of size of particle is obtained.

COLLOIDAL CATALYSTS

Excellent catalysts have been prepared by L. H. Reyerson of the University of Minnesota by reducing upon the disperse surfaces of silica gel microscopic layers of copper, silver, gold, platinum and palladium. This was accomplished by allowing the gel to adsorb hydrogen, which was then able to reduce to the metallic state the metal ions from solutions of the salts of the metals noted. This method of preparation insures maximum metal surface for catalytic reactions.

The catalysts were studied for the simple hydrogenation of ethylene. The palladium catalyst was able to accomplish 90 per cent hydrogenation at zero degrees and one passage of gas through the catalyst. The platinum catalyst caused about 60 per cent conversion under the same conditions, while copper was only 5 per cent effective. A nickel catalyst prepared under modified conditions was also found to be very effective in the reduction of ethylene. It was also used in the reduction of phenol and aniline and found to be very efficient.

The platinum catalyst showed remarkable activity in the oxidation of hydrogen at low temperatures and also in the oxidation of ethylene. Formaldehyde was produced under certain conditions. An attempt was also made to reduce water gas. In two instances tests for formaldehyde were obtained when palladium was used as a catalyst. These results would suggest wide use for the metallized silica gels.

COLLOIDS AND FERTILIZATION

The colloid chemistry of soils was discussed by Emil Truog, Department of Soils, University of Wisconsin, and related subjects by P. L. Gile, U. S. Bureau of Soils and F. J. Alway, of Soils Division, University of Minnesota.

The great value of colloids in soils is their enormous specific surface, which is conducive of all sorts of adsorption phenomena, and which exercises important influences on many factors that affect plant growth. The value of the colloids in water relations is their capacity to absorb water in time of abundance and to give it up in times of drought. The mechanism of nitrogen fixation in soils is believed to be as follows: Bacteria first produce ammonia from the organic matter; this is fixed by the colloid acids, both organic and inorganic; and finally the nitrogen is released for nitrification rather slowly.

As regards phosphorus, the colloids serve as ideal buffers for the phosphoric acid produced by bacterial action and that demanded by the plant roots. In another way the colloids act as absorbers and buffers for bases, like potassium and calcium, releasing them gradually instead of profusely. The colloids also adsorb toxic materials resulting from the heterogeneous addition of various plant and animal materials and artificial fertilizers. Soil acidity is due to colloidal acids, largely inorganic. Their ready adsorption of lime is the basis of the current practice of correcting soil acidity. In general, then, the soil colloids act as stabilizers and regulators of both physical and chemical conditions in soils.

That colloidal study will explain some of the fundamental requirements for the production of a superior quality of lithopone was brought out in an excellent

paper by Charles A. Mann, professor of Chemical Engineering at the University of Minnesota. The following are significant excerpts from that discussion:

Mechanism of Lithopone Formation

Manufacture and Properties—Lithopone is one of the important white pigments used in paints, enamels, for linoleum and for compounding with rubber. It is pure white, very fine in texture, flocculent and non-crystalline,¹ and in a state of sub-division equal to that of white lead. It has the same tinctorial strength but more hiding power than pure zinc oxide. It is non-poisonous, has little or no basicity, and is stable in every medium known for paints except those of high acidity.² It is unaffected by sulphur vapors or gases. It mixes easily with oils and other colors.³ It is insoluble in water, ammonia and alcohol and is practically fire proof.⁴ Carbon dioxide and dilute acid vapors have no effect in it. Unless specially treated light causes it to darken but it becomes white again when it is removed from the light.

This pigment is made by the double decomposition of solutions of ZnSO_4 and BaS in equimolecular proportions so that the product consists primarily of 30 per cent ZnS , 69 per cent BaSO_4 , and 1 per cent ZnO . When so precipitated, lithopone shows the characteristic properties which make it so desirable as a pigment. That it is not a mere mixture becomes evident when molecular proportions of dry ZnS and BaSO_4 are thoroughly ground together. Under these conditions the mixture does not exhibit the same properties as true lithopone. An attempt was therefore made to explain the mechanism of the formation of lithopone which would in part account for some of its characteristic properties.

Suggested Mechanism—When ZnSO_4 solution is added to a solution of BaS or $\text{Ba}(\text{SH})_2$, barium sulphate and zinc sulphide form. As the first particle of each of these materials forms, it is in contact with a large amount of electrolyte having the barium ion common with the BaSO_4 and the S^{2-} or SH^- ion common with the zinc sulphide. The barium ions are adsorbed over the surface of the barium sulphate particle due to the same causes responsible for crystal growth.⁵ As there is not a similar number of SO_4 ions available in the electrolyte the barium sulphate particle does not grow but because of the attached positive ions on its surface it assumes the same charge as the barium ion and becomes positive. At the same time and in a similar way the ZnS attracts the negative S^{2-} or SH^- ion to the surface and becomes negatively charged. The two oppositely charged particles of BaSO_4 and ZnS immediately unite by the neutralization of the charges and form a product which has neither the properties of BaSO_4 or ZnS nor of a common mixture of the two. It is due to this union of the charged particles that the properties of lithopone may be ascribed.

To determine the validity of this assumption a positive barium sulphate colloid and a negative zinc sulphide colloid were prepared, these brought together and the precipitate which formed tested for the properties of lithopone.

The barium sulphate colloid was prepared by slowly adding a solution of sulphuric acid in 60 per cent alcohol to a solution of barium chloride in 60 per cent alcohol with constant stirring. A slight excess of barium chloride was used. A colloidal solution containing 0.1 gm. barium sulphate per c.c. could thus be

obtained which remained in suspension for twenty-four hours. An apparatus proposed by H. Taylor⁶ which had been successfully used by H. A. Weiser⁷ to determine the charge of BaSO_4 was used. This clearly indicated that the BaSO_4 as prepared was positively charged. A ZnS colloidal solution prepared according to a method given by Taylor⁸ by passing hydrogen sulphide through ammoniacal zinc hydroxide solution with a small amount of gum arabic added showed in a like test that the ZnS was negatively charged.

When solutions containing equimolecular quantities of these colloidal solutions were brought together a heavy precipitate formed, the precipitation being complete in twenty minutes. This precipitate when washed and dried appeared similar to commercial lithopones under the microscope. The particles were extremely finely divided and uniform in size and of amorphous character. A seven per cent hydrochloric acid solution produced no H_2S that could be detected with lead acetate paper.

TESTING COLLOIDAL METHOD

To stimulate the conditions under which the colloids would form in making lithopone, another method was used to prepare the colloids. A barium sulphate colloid was made by grinding barium sulphate in a barium sulphide solution of 4 deg. Bé. in a ball mill for fifty hours. For this purpose 50 gm. of the barium sulphate were ground with 250 c.c. of the sulphide solution which supplied the common barium ion. The practically clear solution obtained after filtering through a double thickness of filter paper when tested in the Taylor apparatus showed that a positively charged barium sulphate colloid had been obtained. In like manner, zinc sulphide ground with a solution of barium sulphide in a ball mill produced a negatively charged zinc sulphide due to the presence of the common sulphide ion present in the solution. When these solutions are brought together a precipitate forms, which when washed and dried produces a substance which has the properties of a true lithopone.

From these considerations it seems reasonable that in the mutual precipitation of the barium sulphate and zinc sulphide each takes on a charge which in the neutralization of one by the other forms a union of the colloids and this union may be responsible for the characteristic properties of lithopone.

If this is the mechanism of lithopone formation there should be possible a method of producing lithopone by grinding together barium sulphate and zinc sulphide in the presence of barium sulphide solution. It should be possible also to substitute zinc sulphate for the barium sulphide inasmuch as the zinc sulphate electrolyte has the Zn ion common with the ZnS and the SO_4 ion common with the barium sulphate. In this case the zinc sulphide would become positively charged and the barium sulphate negatively charged. Experiments have been tried to make lithopone by this grinding method but the work has not progressed sufficiently to warrant any definite statement as to its success.

¹Paint Technology and Tests, by Gardner, p. 53.

²Rubber, Resins, Paints and Varnishes, by Morrell and Wade, p. 118.

³Jr. Physical Chemistry (1915), by W. J. O'Brien, pp. 113-44.

⁴White Paints and Painting Material by W. O. Scott, p. 237.

⁵The Origin of the Charge of a Colloidal Particle and Its Neutralization by Electrolytes, by J. N. Mukherjee; Trans. of the Far. Soc. XVI (1920-21) Section on the Physics and Chemistry of Colloids, p. 103.

⁶Chemistry of Colloids, Taylor, Chap. 8, pp. 78, 200 (1915).

⁷Effect of Adsorption on the Physical Character of Precipitated Barium Sulphate, by Harry B. Weiser, Jr. Physical Chem. 21, p. 314.

⁸Chemistry of Colloids, Taylor, Chap. 8, pp. 78, 200 (1915).

Recent Legal Decisions

Digest of typical cases decided in high courts, illustrating principles of law applied to business transactions

INJUNCTION DENIED AGAINST NOISE CAUSED BY OPERATION OF INDUSTRIAL WORKS

In the case of *Hauser vs. Kraeuter & Co., Inc.*, the Court of Chancery, New Jersey, refused to interfere, on the ground of nuisance, with a lawful trade lawfully carried on. The industrial works of Kraeuter & Co., Inc. were located in an appropriate locality and were operated in a circumspect manner during working hours. Under these conditions the court held that noise characteristic of the enterprise must be endured by those who from choice or necessity lived in the vicinity.

UNJUST DISCRIMINATION IN TAX ON SALE OF GASOLINE

A Montana statute provided that every distributor of gasoline within the state should pay an annual license tax of 2c. per gallon on gasoline manufactured and sold by him in the state or shipped into by and sold by him within the state, except that no imported gasoline sold in original packages should be included in determining the amount of the tax. The Sunburst Refining Co. contended that the enforcement of this statute would be an unjust discrimination against its business and in favor of its competitors, since both foreign and domestic corporations were purchasing gasoline in other states and shipping it into Montana in original packages. The Supreme Court of Montana decided that the statute was such an arbitrary and unjust discrimination against those dealing in Montana-made gasoline as to deny them equal protection of the law.

ACCEPTANCE BY SELLER OF A CHECK MARKED "IN FULL" RESCINDS CONTRACT

The Rogers Pyatt Shellac Co. sold certain goods to the Starr Piano Co. for future delivery. The latter several times postponed the date of delivery and then wrote to the Rogers Pyatt Co. offering to make a settlement if the contract was cancelled. Rogers Pyatt Co. agreed to accept \$9,800 in settlement, whereupon the Starr Piano Co. sent a check for \$4,900 upon which was written "in full for cancellation of unfilled orders." The Rogers Pyatt Co. received and deposited the check and then wrote the Starr company that the amount would be credited on account. In a subsequent suit to recover the remainder the Appellate Division of the N. Y. Supreme Court held that the acceptance of the check acted as an accord and satisfaction and was a rescission of the contract.

DOMESTIC COURTS HAVE JURISDICTION WHERE RESIDENT CITIZEN SUES FOREIGN CORPORATION

Sudbury, a citizen of the U. S. and resident of New York, made a contract with *Ambi Verwaltung Kommanditgesellschaft Auf Aktien* for the sale of certain stock in a German corporation. The contract was made

in Germany, in the German language, and contained a clause providing that in case disputes should arise out of the contract only German law should apply and that German courts should have exclusive jurisdiction. The Appellate Division of the N. Y. Supreme Court held that it is against public policy to confer exclusive jurisdiction in such cases upon a foreign tribunal, and that any agreement by which the parties to such a contract, one of whom is a resident of New York, undertake to oust the courts of New York from jurisdiction is null and void.

FULTON PATENT FOR CORRUGATED METAL WALLS FOR COLLAPSIBLE AND EXPANSIBLE VESSELS DECLARED VALID AND INFRINGED

The patented process of making flexible corrugated metal bellows owned and operated by the Fulton Co., Knoxville, Tenn., was declared valid and infringed by the Bishop & Babcock Co. of Ohio, in a decision rendered by Judge Westenhaver of the U. S. District Court for the Northern District of Ohio on May 15, 1925. The same process was held valid and infringed by the Janesville Laboratories, Inc., and Edgar J. Leach by the U. S. District Court for the Western District of Wisconsin. The process in question, described in patent 971,838, is for making flexible corrugated metal walls for vessels in the form of a bellows. The product is known in industry by the trade name of Sylphon and is used largely for temperature control.

DESIGN PATENT AND STRUCTURAL PATENT DOES NOT CONSTITUTE A CASE OF DOUBLE PATENTING

In the case of *Mathieu vs. Mitchell-Vance Co., Inc.*, the plaintiff applied for and received a design patent for a globe for lighting fixtures, and four months later received a structural patent, the drawings of which showed a globe of the same exterior as that of the design patent. The design patent did not indicate the material for the globe nor did it show how the globe was to be made. The structural patent on the other hand indicated these things and put forward as invention a unitary globe responding to certain laws of optics regarding the reflection and diffusion of light. The U. S. Circuit Court of Appeals, Second Circuit, decided that the structural patent was not a case of double patenting over the earlier design patent.

EMPLOYEE REFUSING MEDICAL TREATMENT FORFEITS RIGHT TO COMPENSATION

Workmen's compensation was awarded to one Pettus for a severe injury, such compensation to continue until termination of his disability. Competent physicians testified that if the plaintiff would submit to wearing a plaster cast for six months and remain quiet his injuries would heal. He was taken to a hospital and put into a cast but the next day he broke the cast from his body and left the hospital. He was ordered back and put in another cast but again broke loose. He thereafter refused to return to the hospital or submit to further treatment. The Supreme Court of Oklahoma held that the Commission should enter an order refusing him further compensation. Where a workman unreasonably refuses to submit to treatment reasonably certain to effect a cure, continued disability results not from the injury but from his own wilful act,

On the Engineer's Book Shelf

Getting Employers and Employees Together

EMPLOYEES' REPRESENTATION IN COAL MINES. By Ben M. Selekman and Mary Van Kleeck, Department of Industrial Studies, Russell Sage Foundation, New York. 454 pp. Price, \$2.

Reviewed by P. B. McDonald

This is a companion volume to "Employees' Representation in Steel Works" reviewed in *Chem. & Met.* for May. It analyzes in detail the Rockefeller plan of organizing employees and officials of the Colorado Fuel & Iron Company in order to confer about grievances. The plan was worked out following the Colorado strike of 1913 and 1914, and was the first notable experiment of its kind in the country.

The authors of the book, Mr. Selekman and Miss Van Kleeck, are not entirely enthusiastic over the plan after their personal investigation of it; nor are they favorably impressed by the living conditions of the miners at the score or so mines of the company in Colorado and Wyoming. Mr. Rockefeller and the company officials do not agree with all the implications of the book. Yet the plan has had some good effects. It probably is a passing phase in industrial development, and many of its ramifications are local in significance; labor troubles are often due to petty personal animosities about which it is impossible to legislate broadly, and the remedy lies in appointing a new manager rather than in evolving a cumbersome system of committees.

Granted, however, that the plan is worth an analysis of nearly five hundred pages of a book, rather than an article or two in a technical magazine, it must be admitted that the authors have done a careful and judicial piece of work. Their point of view is not that of the late Russell Sage, but there is no necessity that it be.

Physico-Chemical Evolution

PHYSICO-CHEMICAL EVOLUTION. By Ch. Eug. Guye, Professor of Physics at the University of Geneva. Translated from the French by J. R. Clarke, University of Sheffield. E. P. Dutton and Company, New York. 172 pp. Price, \$2.40.

Reviewed by George L. Clark

Into this volume are collected three previously published papers by Professor Guye bearing upon the relation of generality and probability of physico-chemical phenomena and the evolution of living organisms. "It is well known that, since the investigations of Gibbs and Boltzmann, the principle of Carnot has assumed a new and unexpected significance, in the sense that the physico-chemical evolution of a system takes place toward states of greatest probability, equilibrium occurring when this probability is a maximum in the analytical sense of the term. The change of entropy, which, in the language of thermodynamics, characterizes this evolution will be proportional to the difference between the logarithms of the probabilities of the initial and final states. Thus this new conception has intro-

duced, with a particularly strong intensity, into the domain of physical chemistry the idea of the 'statistical law' with all the consequences it involves from the scientific and philosophical point of view. By virtue of these conceptions the determinism of physico-chemical evolution appears, therefore, as a larger *statistical determinism* in which the apparently inevitable exactness is only due to the law of large numbers. In fact, this determinism permits the occurrence of other very rare possibilities or *fluctuations*, particularly when the law of large numbers is no longer entirely satisfied. For this reason, the question of *absolute determinism* is transferred into the domain of the *individual actions* between molecules, atoms and electrons which still evade our direct experimental investigations almost completely."

The first paper on "Einstein's Principle of Relativity in Its Relation to the Classification of the Sciences," while not intimately connected with the primary thesis, serves to show how the principle of relativity is a first step toward the union of the sciences which are metaphysically separated by their foundation conceptions, and to outline the position of physics and chemistry with respect to other sciences, particularly biology and psychology. The second paper on "The Evolution of Physico-Chemical Phenomena and the Calculus of Probabilities" presents the main body of the subject matter outlined above; and the third on "Carnot's Principle and the Physico-Chemical Evolution of Living Organisms" goes the step further in showing that the physical chemistry of living beings, or physiology, is a more generalized science in the sense that when it is applied to extremely differentiated media the statistical fluctuations are no longer negligible. This conception culminates in a unicist philosophy. Life itself may be a rare type of fluctuation but the cause and the origin of the organization of life and thought must be sought in individual actions.

The reader, whether he be skilled physical chemist, biologist, philosopher or layman will find this little book exceptionally stimulating. In this world of facts and details it is all too easy to lose the larger and deeper perceptions which constitute the mainspring of the spirit of research. Professor Guye, renowned creative scientist that he is, is eminently fitted to guide with steady and clear analysis the untrained mental processes of others from the realm of fact out to the realm of metaphysics. And whether or not we agree with a unicist philosophy our belief in a dualist philosophy can only find its foundation in a clear understanding of experimental foundations.

The author has not only done a good service in the stimulation of thought, but also in the urge toward further scientific researches with a deepened purpose never before appreciated. He writes with remarkable clarity, an enthusiasm moderated by never relinquished dignity and seriousness, and an incontrovertible scientific logic. His message is unhampered by the excellent

translation. The reader will find the book a difficult one to put down until its perusal is complete; there will be something lacking in him if its revelations do not awaken a new consciousness of values even though the conclusions may antagonize his own potential philosophy.

Distillation Principles

DISTILLATION PRINCIPLES. By C. Elliott. D. Van Nostrand Co., New York. 166 pp. Price, \$2.

Reviewed by Clark S. Robinson

This little book is an excellent compilation of our present ideas about the theory of distillation, from the standpoint of the physical chemist. The reviewer's only criticism is the likelihood that the chemical engineer for whom the book is intended will find it rather concentrated nourishment unless he has had a thorough-going course in physical chemistry.

The book makes no attempt to go into the theory of *fractional* distillation, this probably being reserved for the companion volume promised on "Distillation in Practice."

It is unfortunate that the publishers did not take more care in the binding of the book.

Nitroglycerin Technology

NITROGLYCERIN AND RELATED COMPOUNDS. By Ph. Naoum. Julius Springer, Berlin. 416 pp. Price, \$4.50.

Reviewed by Robert Schless

Dr. Naoum's is the first book to appear after the World War to be entirely devoted to the technology of nitroglycerin and related compounds and to commercial explosives into which they enter as principal ingredients. Being written by a chemist in charge of the scientific laboratory of one of the largest German explosives manufacturing concerns (Dynamit-Actiengesellschaft vorm. Alfred Nobel & Co.) and based on his 20 years' practical experience with explosives and his own numerous investigations, this work is of interest to any technologist connected with the manufacture, testing or use of explosives. It contains considerable information not covered by older literature on the subject and being a description of modern German manufacturing methods it offers the American reader an authoritative source of comparison of his methods and products with those of Germany.

Regarding the process of nitrating glycerin it is of interest to note that in Germany, lead is used almost entirely as material of construction of nitrating apparatus and compressed air is used for agitation. In America, steel nitrators and mechanical agitation are the standard practice. Five hundred and fifty pounds of glycerin is the largest amount used in German and other European plants in one nitrating operation, whereas as high as 1,300-1,400 lb. are used in the larger American plants. Yields of nitroglycerin obtained in America compare favorably with those in Germany, where 230-231 per cent is considered a good yield, using brine refrigeration.

In the cartridging or so-called packing operation, American methods by far surpass the European in their efficiency.

Of special interest to explosives chemists is the

author's experimental work described in the book on the effect of composition of mixed acid on the yield of nitroglycerin.

In the chapter on chemical stability of nitroglycerin, valuable information is contained helping to clear some abnormal phenomena the chemist is at times confronted with in conducting the Abel stability test.

Numerous compounds related to glycerin and their nitration products used in the explosives industry are described with more detail than has appeared in older literature.

The reader will find numerous formulas and processes of production of explosives of which nitroglycerin and these compounds are the main ingredients.

Steps have been taken by the author of this review to secure the right of translating Dr. Naoum's book into English.

Aniline and Derivatives

ANILINE AND ITS DERIVATIVES. By P. H. Groggins, chemical engineer. D. Van Nostrand Co., New York. 256 pp. Price, \$4.

Reviewed by S. D. Kirkpatrick

Actual use is, after all, the best index of the utility of a product whether it is a new tool, a piece of apparatus or a technical book. During the several months that "Aniline and Its Derivatives" has reposed on the *Chem. & Met.* bookshelf, we have had many occasions to refer to it and the results are ample proof that it is a technical reference book of real usefulness to the chemical engineer. Lately, more leisurely study has revealed some unlooked for qualities that have lifted the book quite out of the realm of the usual textbook. This is first implied in the author's preface that holds this significant statement:

"It is not sufficient for the chemical engineer to study the underlying reactions of a process, to construct a plant based on such findings and to supervise the operations for the production of a satisfactory product—he must also assume responsibility for the most economic conversion of raw materials to finished products, in order to insure the existence and continuation of the industry."

In keeping with this purpose, the author has included in his book, in addition to the bare technology of the aniline industry, much of fundamental economics, pertinent cost data, price trends, import, export and production statistics and other of the basic indicators of business. A good measure of homely philosophy also finds its way into the several chapters, as for example, there is the little homily on the short but riotous career of the inefficient dye producer who fell by the wayside during the post-war slump when "only those who applied the science of chemical control could hope to be rewarded."

A unique view of chemical control and a plan to make it most effective from a dollars-and-cents viewpoint are to be found in the suggestion of a chemical budget in which the chemical engineer uses "material losses" in place of expenses in budgeting his plant operations. A "Sources of Losses Chart" becomes the balance sheet to show the profits from increased yields and more efficient production.

"Aniline and Its Derivatives" is broader than its name implies. It is more than a commendable text or handbook; it is an interesting story of American chemical engineering practice, principles and experience.

Readers' Views and Comments

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Courtesy to Applicants

To the Editor of Chem. & Met.:

Sir—Your editorial "Courtesy to Applicants" on the frontispiece of the May number can be extended to cover the entire practice of placing blind advertisements for technical positions.

Such advertisements ask the applicant to state the details of his record, age, salary, and references, and do so without revealing the name of the firm which is placing the advertisement and may be his future employer.

Blind advertisements frequently state that replies will not be considered unless full particulars are stated in the first letter. The statement, that all replies will be considered as confidential, does not in any way offset the disadvantage in which any applicant places himself in answering such an advertisement.

In soliciting employment the applicant is selling his services. Would any reputable firm sell goods by stating full particulars and details, their lowest price, etc., and do so without knowing to whom they were quoting? One fundamental of good business is to know that you are dealing with firms of good standing.

It not infrequently happens that replies to blind advertisements return to the applicant's present employer. Also, the replies received from such advertisements show that some are a disadvantage to the applicant—that had he known to whom he was writing, the application would not have been written.

Technical publications can well establish a standard of advertisement which will control or eliminate the blind advertisement. This same point can be carried to technical societies by their demanding that all advertisements requiring specific information make their source known to the applicant. This demand will go a long way towards elevating the standard and respect held for technical help. Any applicant can make a better proposal if he knows to whom the application is being made.

One point is certain; any applicant for employment who will state his full record, salary consideration, and references, and do so without knowing to whom the application is being addressed, is lacking in one very essential business qualification.

NEWTON L. HALL.

La Salle, Ill.

EDITOR'S NOTE. The condition complained of by Mr. Hall has vexed many others, but no remedy is evident. The shoe is on the other foot when men advertise for positions and use blind ads. Apparently there are many reasons why both employers and employees desire to conceal their identity when seeking new relationships.

530 and 600 B.t.u. Gases

Note by Editor:

The original report of the Detroit Testing Laboratory which is under discussion made an unfortunately sweeping statement to the effect that "530 B.t.u. gas

has an economic value sufficiently greater than 600 B.t.u. gas (as ordinarily used before adopting the 530 B.t.u. value) to actually reduce gas bills over those obtaining with 600 B.t.u. gas in use before the change in value was adopted." A careful analysis and correct averaging of the Laboratory's figures, carried out by the Bureau of Standards, makes it evident that even under the unusual conditions of testing adopted by the Detroit Testing Laboratory such conclusions had no evident foundation.

It is unfortunate that a reputable consulting agency of this character should have given out a report with conclusions so at variance with its own data. It appears that the Bureau of Standards has rendered a real service to the gas industry, as well as to industrial and household users of gas, in bringing out the correct conclusions with respect to this matter.

Although the Detroit Testing Laboratory does not in any way attempt to refute these technical conclusions of the Bureau, it does present certain comments which it desires to have on record.

To the Editor of Chem. & Met.:

Sir—In your May issue you have given space in your editorial columns and also in an article presumably by a member of the staff of the Bureau of Standards dealing at some length in a disparaging manner with a discussion of a report made by the Detroit Testing Laboratory to the Common Council of the City of Detroit on gas efficiencies. In justice to the authors of the report, and in defense of the conclusions drawn from the exhaustive tests covered in this report may we presume upon your fair treatment to publish a brief statement of facts surrounding the discussion of our report?

Generally speaking, the value of any fuel depends upon the amount of useful work it will perform. When a fuel is used without regard to economy in obsolete equipment such as frequently found in the burning of gas by the householder, any improvement in fuel or appliance adjustment should be welcome both by producer and consumer.

The Detroit Testing Laboratory was given a definite job, viz., to determine whether 600 B.t.u. gas was more economical for the average householder to use or whether he should use 530 B.t.u. gas.

Notwithstanding the fact that both gases were tested on the same apparatus and the highest efficiencies obtainable on both gases with that equipment are clearly stated in our report, a strenuous effort has been made by the Bureau of Standards to discredit both the accuracy of the work and the conclusions drawn from the observations made.

With all due respect for the opinions of the Bureau's staff, we are none the less convinced that our conclusions are in keeping with the facts developed in the course of our work, when all the data are considered. A criticism such as that of the Bureau on our report should be primarily one of scientific interest shorn of all bias, and this we contend has not been done, as

evidenced by a demand that a public statement be made, correcting our conclusions. We refused to enter any such retractions, knowing full well that the evidence we had produced, is in line with what others have found, and who are backing their findings by changing equipment to gain the advantage offered by gas of even lower B.t.u. value than 530 B.t.u. per cubic foot.

The principal point at issue is whether gas should be burned at a definite B.t.u. throughput per unit of time or a definite volume throughput per unit of time, giving due attention to permissible amounts of CO produced under all settings. A *final word* in any application of scientific work to economic conditions means perfection or stagnation. Do you contend that perfection has been reached in the application of gaseous fuel to industry or even in the household?

The work which The Detroit Testing Laboratory performed for the Common Council of the City of Detroit on gas efficiencies clearly pointed out that 530 B.t.u. gas when burned under *the most favorable conditions for that gas* would perform as much, and in some case more useful work than could be performed with 600 B.t.u. gas with the same equipment and under the *most favorable conditions that could be obtained with that equipment*. These efficiencies were made on top burner ranges. The oven test formed only a minor part of the series of tests run. Some of these tests have been repeated recently in our laboratory, using a carefully calibrated wet meter, and check very closely the results published in our report to the Common Council of the City of Detroit. These recent tests demonstrate that our methods of measuring gas by the "flow meter" so severely criticized by the Bureau of Standards are not in disagreement with the facts as published.

The reasons for these differences in efficiencies in favor of the lower B.t.u. gas lie in the B.t.u. per cubic foot of the products of combustion, the theoretical flame temperature to an undetermined radiation factor and perfection in mixing the gas and air, not in the gross B.t.u. per cu.ft. of gas burned, so erroneously held.

We can point to installations where the same or greater efficiencies are being obtained with producer gas of 175 B.t.u. per cu.ft. than are obtained with 550-600 B.t.u. gas when doing the same work in the same time. With such examples as evidence of what can be done in industry, we are convinced that the *final word* in the value of gases for domestic use has not been printed. We firmly believe that no final conclusion can be drawn on the value of gases for industry or domestic use without a vast amount of further research on the problems involved. Surely it is a problem replete with rich rewards when solved to meet changing conditions and developments. "Progress involves change; it often requires the scrapping of cherished theories, prejudices, and opinions built on an imperfect understanding of the facts of science."

Detroit, Mich. THE DETROIT TESTING LABORATORY,
W. P. PUTNAM,
President and General Manager.

To the Editor of Chem. & Met.:

Sir—We believe that the statement from the Detroit Testing Laboratory in their letter to you dated June 3 requires little comment, except to again point out the fact that the results which they criticize were the results actually obtained by their own laboratory, as shown by their original data sheets. All the tests accepted by the Detroit Laboratory as significant and

supplied to the Bureau were used. The only thing the Bureau did was to average these data and report the result.

It is true that the correspondence between the Bureau and the Detroit Testing Laboratory shows a difference of opinion regarding the proper method of making efficiency tests. The Bureau believes that the efficiency of gases should be compared when they are used to produce the same useful effect in the same time; the Detroit Testing Laboratory apparently believes that they should always be compared when burned at the same rate (in cubic feet per hour) and that any difference in time required should be ignored. This difference of opinion did not, however, in any way enter into the discussion by the Bureau in the May issue of *Chemical & Metallurgical Engineering* of the tests made by the Detroit Testing Laboratory. The Bureau simply summarized in the most simple manner the data furnished by that Laboratory and did not even criticize the basis of comparison employed in making the tests. Even on that basis, however, the results showed the same useful effect from the same amount of heat in either gas. The Bureau has never questioned, even in the voluminous correspondence which has been exchanged, the reproducibility of the results actually obtained by the Detroit Laboratory; reiteration of the fact that these results have been reproduced, therefore, has no importance.

In view of the fact that efficiency tests upon top burners have been made by a great number of observers who have in the main obtained concordant results (which agree with the results actually obtained by the Detroit Laboratory) far more space has already been given to the discussion of these tests upon a single burner than their relative importance would justify. Anyone further interested in the Bureau's detailed criticism of the Report of the Detroit Testing Laboratory as rendered to that institution may obtain a mimeographed copy upon application to the Bureau of Standards.

BUREAU OF STANDARDS,

Washington, D. C.

GEORGE K. BURGESS,

Director.

Evaluating Corrosion Tests

In a preprint of the *American Society for Testing Materials* entitled "The Evaluation of Corrosion Tests," by E. Blough, are given data on the physical examination of non-ferrous test pieces. After reviewing briefly the 4 common methods of measuring corrosion i.e., (1) by inspection, (2) by loss in weight of test piece, (3) by analysis of corrosion products, and (4) by measuring the depth of pitting, the author says:

"One common criticism applies to all of the above methods of determining the effect of corrosion, and that is they do not disclose the effect corrosion has produced upon the residual metal which is apparently unattacked.

"One method of measurement which avoids the above-mentioned criticism is to subject the specimens after corrosion to physical tests. If the corrosion specimens are prepared in the form of test pieces, then they may be tested at least for tensile strength and elongation. By measurement of these properties both before and after the material has been subjected to corrosion, and for various lengths of time, a very good picture is obtained as to the effect of the corrosion on the material itself." Tests lasting more than 2,000 hr. showed appreciable differences in the metals tested.

Recent Articles in Technical Periodical Literature

By P. K. Frölich

Massachusetts Institute of Technology

Electrochemical Industry. Progress in electrochemical industry from 1920 to 1924. R. Meingast. *Chem. Ztg.*, 1925, vol. 49, pp. 377-8; 417-8; 446-7; 461-2; 473-4.

Sand-Lime Brick. Effect of sulphates and chlorides in the hardening of sand-lime brick. Justin-Mueller. *Chem. Zeit.*, 1925, vol. 49, pp. 390-1.

Peat. New method of drying peat. K. Homolka. *Chem. Ztg.*, 1925, vol. 49, pp. 391-2.

Chlorination of Water. Experience with the operation of a chlorination plant. F. Egger. *Chem. Ztg.*, 1925, vol. 49, pp. 398-9.

Artificial Silk. Artificial silk industry in Germany and its relation to foreign countries. W. A. Dyes. *Chem. Ztg.*, 1925, vol. 49, pp. 401-3.

Gypsum. Effect of gases on gypsum at higher temperatures. P. P. Budinkoff. *Chem. Ztg.*, 1925, vol. 49, pp. 430-1.

Fertilizers. World production and consumption of the most important potassium-, phosphate- and nitrogen-containing fertilizers before and after the war. P. Kriesche. *Chem. Ztg.*, 1925, vol. 49, pp. 453-5.

Methanol. A short note by which the Badische Anilin u. Soda-Fabrik seeks to establish priority to the process for making synthetic methanol over Patart's claims in recent publications. *Chem. Ztg.*, 1925, vol. 49, p. 463.

Centrifugal Pumps. Pumps designed for deep wells. Anon. *Apparatebau*, 1925, vol. 37, pp. 119-20.

Evaporation. Comparison between a vacuum evaporator and a multiple-effect pressure evaporator. F. Ständer. *Z. Ver Deutschen Zucker-Ind.*, 1925, No. 824, pp. 367-75.

Lime Burning. Summary of the scientific principle of lime burning. G. Keppler. *Z. angew. Chem.*, 1925, vol. 38, pp. 397-405.

Oxygen. Discussion of oxygen supply for industry. G. Kassner. *Z. angew. Chem.*, 1925, vol. 38, pp. 405-7.

Cooling of Gases. Cooling of gases with regeneration of heat. J. Fabian. *Z. angew. Chem.*, 1925, vol. 38, pp. 485-8.

Smokeless Fuel. Smokeless fuel and oil fuel with special reference to low-temperature carbonization processes. C. H. Lauder. *Chem. & Ind.*, 1924, vol. 44, pp. 521-4.

Crushing and Grinding. Discussion of equipment for crushing and grinding including ball mills, tube mills and ring-roll mills. S. G. Ure. *Chem. & Ind.*, 1924, vol. 44, pp. 551-9.

Synthetic Alcohol. Synthesis of ethyl alcohol from ethylene in coke-oven gases is now possible on a commercial scale. Description of process and installation. F. Vallette. *Chem. & Ind.*, 1925, vol. 13, pp. 718-22.

Motor Fuel. Fuel crisis and proposed

remedies (continued). Synthesis of methanol from carbon monoxide and hydrogen. Oxidation of hydrocarbons to liquid fuels. A. Travers. *Chem. & Ind.*, 1925, vol. 13, pp. 722-31.

France. Present conditions of the French chemical industry (continued). E. Grandmougin. *Rev. Chim. Ind.*, 1925, vol. 34, pp. 106-9; 138-42. The chemical "war" and production capacity of French organic chemical industry. Anon. *Ibid.*, pp. 109-11; 145-8.

Leather. Effect of the War on the French leather industry. M. Gillet. *Rev. Chim. Ind.*, 1925, vol. 34, pp. 142-5.

Methanol. Review of recent methods for making synthetic methanol. R. T. Elworthy. *Canad. Chem. & Met.*, 1925, vol. 9, p. 139.

Ammonia. Synthetic versus byproduct ammonia in Europe. *Canad. Chem. & Met.*, 1925, vol. 9, pp. 131-4.

Aluminum Paint. Light transmission and waterproofing efficiency factor of aluminum paint. J. D. Edwards and R. I. Wray. *Ind. & Eng. Chem.*, 1925, vol. 17, pp. 639-41.

Contact Acid. Influence of reaction rate on operating conditions in manufacture of contact sulphuric acid. W. K. Lewis and E. D. Ries. *Ind. & Eng. Chem.*, 1925, vol. 17, pp. 593-8.

Government Publications

Rubber specifications. Approximately 20 new Government master specifications for rubber articles in the form of circulars of the Bureau of Standards giving the Federal Specification Board requirements, including circulars numbered as follows:

No. 114, Fire Hose; No. 209, Oil Suction Hose; No. 217, Surgeons' Gloves; No. 218, Rubber Dam; No. 219, Rubber Bandages; No. 220, Stomach or Lavage Tube; No. 221, Colon Tube; No. 222, Politzer Bags; No. 223, Rubber Tips for Crutches; No. 224, Rubber Pillowcases; No. 225, Rubber Catheters; No. 226, Rubber Finger Cots; No. 227, Rubber Ice Bags; No. 228, Helmet-Shaped Ice Bags; No. 229, Friction Tape; No. 230, Rubber Tape.

Gypsum Plaster Board, Bureau of Standards Circular No. 210, includes Federal Specifications Board requirements.

Gypsum Wall Board, Bureau of Standards Circular No. 211, gives Federal Specifications Board requirements.

Calcium Gypsum, Bureau of Standards Circular No. 206.

Rust Preventive Compounds, Bureau of Standards Circular No. 214. Specifications for medium and light compounds as required by the Federal Specifications Board.

Leather Specifications. Lace Leather in Circular No. 215 of the Bureau of Standards and upholstery leather in Circular No. 212 of the Bureau of Standards.

The Dew Points of Fuel-Air Mixtures by R. J. Kennedy, Bureau of Standards Scientific Paper No. 500. Theory and charts for analytical determinations.

Titanium-Zinc Paint Specifications, Bureau of Standards Circular No. 215.

Malleability and Metallography of Nickel by P. D. Merica and R. G. Waltenberg. Bureau of Standards Technologic Paper No. 281.

Mineral statistics—Production and market statistics on the following subjects have been issued in the form of mimeographed summaries by the U. S. Geological Survey:

Talc and Soapstone; Phosphate Rock; Asphalt and Related Bitumens; Platinum and Allied Metals; Aluminum Salts; The Copper Industry; Gold, Silver, Copper, Lead and Zinc, 1924; Feldspar; Natural Abrasives; By-Product Coke and Coke By-Products.

The Melrose Phosphate Field, Montana, by R. W. Richards and J. T. Pardee, U. S. Geological Survey Bulletin No. 780-A.

Recent Developments in the Production and Consumption of Abrasive Garnet by W. M. Myers and C. O. Anderson. Serial No. 2691 of the Bureau of Mines.

The Treatment of Manganese-Silver Ores, by G. H. Clevenger and M. H. Caron. Bureau of Mines Bulletin No. 226.

Investigation of Toxic Gases from Mexican and other High-Sulphur Petroleum and Products, by R. R. Sayers, A. C. Fieldner and others. Bureau of Mines Bulletin No. 231.

Sources of Limestone, Gypsum and Anhydrite for Dusting Coal Mines to Prevent Explosions, by Oliver Bowles. Bureau of Mines Bulletin No. 247.

Bituminous Coal as Generator Fuel for Large Water-Gas Sets with Waste-Heat Boilers, by W. A. Dunkley. Bureau of Mines Technical Paper No. 335.

Method for Determining Gum-Forming Material in Gasoline by M. B. Cooke. Bureau of Mines Serial No. 2686.

Explosives used in March, 1925, by W. W. Adams. Bureau of Mines Serial No. 2687.

Methods Used for Dehydration of Oil-Field Emulsions, by D. B. Dow. Bureau of Mines Serial No. 2688.

Petroleum Refineries and Cracking Plants. Bureau of Mines mimeographed lists of new petroleum refineries and of all petroleum cracking plants.

Production of Gasoline by Cracking, mimeographed report of the U. S. Bureau of Mines.

Carbon-Monoxide Literature by R. R. Sayers and Sara J. Davenport. Public Health Bulletin No. 150.

Control of Decay in Pulp and Pulp Wood (with bibliography) by Otto Kress, C. J. Humphrey, C. A. Richards, M. W. Bray, and J. A. Staidl. Department of Agriculture Bulletin No. 1298.

Turpentine and Rosin Production. Census of 1923. Unnumbered report of Census Bureau.

Paints, Pigments, and Varnishes in West Indies by J. W. Wizeman. Trade Information Bulletin No. 341, Bureau of Foreign and Domestic Commerce.

Crude Rubber Survey by David M. Figart. Foreign and Domestic Commerce Bureau Trade Promotion Series 2. A report on world markets and resources.

Wages and hours of labor in paper and pulp industry, 1923. Labor Statistics Bureau Bulletin 365.

The Plant Notebook

An Exchange for Operating Men

A Viscosimeter for Use at High Temperatures

By C. B. Bellis

Consulting Metallurgist, Boston, Mass.

It is often necessary, or at least useful, to know the fluidity or its reciprocal, the viscosity, of a liquid at some elevated temperature. For instance, in the fluid transmission of heat, the viscosity is an important factor and the viscosimeter here described was developed for measuring the viscosity of a liquid heat transmission medium at temperatures from 300 deg. F. to 1800 deg. F.

In this device, a series-wound electric motor with dry cells as a source of power is employed. This motor drives a small paddle wheel, directly connected to its shaft by means of a long piece of shafting. A rheostat across the terminals of the motor serves to vary its voltage and this voltage is measured by a voltmeter. A speed indicator or tachometer is attached to the motor shaft. This can be simply done by using a worm on the shaft and meshing this worm with a wheel that gives a reduction of 50:1 or 100:1. The speed can then be determined by timing the revolutions of the wheel.

The device is calibrated by immersing the paddle wheel in various liquids of known viscosity and noting the voltage necessary to give any convenient speed that may be chosen. A table should be made up showing voltage, speed and viscosity for various liquids of known viscosity. Then, to measure the viscosity of a liquid of unknown viscosity, the paddle wheel is immersed in the liquid, no matter what its temperature, and the voltage necessary to give a certain speed is noted. By comparison with the table of speeds and voltage of liquids of known viscosity, it is then possible to determine with fair accuracy, the viscosity of the unknown.

Method for Eliminating Rust in Water

The tendency of rust to form and loosen in iron water pipes is the cause of difficulty in many industrial plants. This "red water" as it is called has proved to be open to successful treatment by various methods—either by deoxidation hot in Speller apparatus or by hot or cold treatment in a special apparatus that has proved very useful in laundries.

This consists essentially of an iron tank—it may be, for instance, an old water boiler—fitted with inlet and outlet on the upper side. This is filled with solid sodium silicate and the water is forced through. Enough of this salt is dissolved to coat the inside of the pipes of the plant within

2 or 3 weeks. A film is formed that is sufficiently dense to prevent loosening of oxide, and at least 80 per cent of the amount normally formed can be prevented in this way.

The rate of flow must be nearly uniform to obtain best results from apparatus of this kind. Likewise a uniform grade of silicate must be used. The unit may obviously be cut out of the system temporarily without losing the effect of the film, but if not replaced within 2 or 3 weeks the effect will be entirely lost and a fresh start has to be made.

In designing and locating the tank the two factors deserving greatest attention are, first, placing so as to obtain uniform flow at nearly uniform temperature and, second, obtaining the least possible pressure drop through the unit.

Methods for the Elimination of Static Electricity

By D. E. Whitlock

Chief Chemist, Keuffel & Esser Co.
Hoboken, N. J.

Although static electricity is one of the commonest of occurrences, and there have been published numerous methods of dealing with it which are more or less difficult of application; it is in the belief that the following simple method of eliminating this troublesome phenomenon is not generally known, that the experiences and remedy given below are set forth.

The writer, who has been employed for a number of years in the Hoboken factory of Keuffel & Esser Co., has observed several instances in which "static" has actually interfered with production. This has been especially true in regard to the handling of paper, both in the continuous roll and sheet form.

One of the most notable examples of this was in the case of a festoon paper dryer, similar to those employed in wall paper and textile printing establishments, and which in our case was used to dry cross-section paper, printed in continuous rolls. The paper as fed to this dryer from the blanket of a copper roller cylinder press, was automatically hung in loops about nine feet in length, upon bars which moved slowly but continuously from the front to the rolling-up end of the machine.

Two kinds of paper were ordinarily run; a thick drawing paper, which gave but very little trouble, and a thin, highly calendered tracing paper which seemed to be particularly susceptible to static charges. This latter was a source of unending difficulties, which in general fell within one of the three following classes: Either the paper stuck to the blanket of the printing machine and was carried back into the

press; or the loops of paper repelled each other while passing through the dryer, causing disalignment and hence poor and uneven rolling up; or worst of all, the lower ends of the loops would swing out to the side, and turning at right angles to their normal position, attach themselves to the sides of the dryer with such tenacity as to pull the paper from the moving bars. Static discharges three and four inches in length could easily be obtained from the paper.

Various methods of overcoming this difficulty such as stringing bare copper wire across, over and under the paper where it left the press, sprinkling water on the heating coils installed in the bottom of the dryer, suspending rags in pails of water at either side of the dryer, etc., were tried without success.

It was at last found that ordinary Christmas tree tinsel (that having thin copper wire in addition to string as a base) would remove these charges so that none could be detected by the sensitive hairs on the back of the hand. This is in accordance with the well-known principle of rapid and silent discharge by means of sharp points.

Our method of employing this material was to suspend strands of it across the machine, both over and under the paper as it left the printing press. Strands at two or three different positions were used for surety, and all were properly grounded to the machine. It was further found necessary to ground the machine to the building by connecting it to water pipes etc., as otherwise a charge soon built up on the dryer and conditions were as bad as ever. No apparent difference could be detected between the action of long and short fibered tinsel, nor was it found necessary for the points of the material to actually touch the paper. However, no harm was done by such contact, even on the freshly printed surface. After applying the above simple remedy, no further difficulty with static electricity was ever experienced with this machine.

Another instance of a somewhat different nature, in which the same remedy proved effective, may also be mentioned. In rerolling blueprint paper into 50 and 100 yd. rolls from the original rolls of prepared stock, the friction of the exceedingly dry paper (under 2 per cent moisture) passing at high speed over the wooden table tops of the "rolling off" machines, generated a considerable charge of static. This at intervals would jump across to the operator, giving him a rather painful shock. It was found that a single strand of the tinsel, tacked along the edge of the table top nearest the operator, and grounded to the metal frame of the machine, entirely eliminated this difficulty. No

grounding of the machine to the building was found necessary in this case.

As a still further example of the remarkable results obtained with tinsel, its use on a sheet fed printing press may be described. This press, which is a rather late development of the type used for printing sheets from photo-engraved copper rollers, delivers the printed sheets by means of "half circles" onto a series of corrugated, galvanized drying-pans. Due to static charges resulting from the enormous pressure and very slight difference in speed between the felt covered impression cylinder and the copper printing roller, the sheets clung to the half circles too long and were delivered half-off and half-on the pans. Again the only method which was found to correct this was by using tinsel, which removed the charge and let the sheets fall naturally.

Hence, as illustrated by the above examples, we have found that a simple and economical method of coping with the troublesome phenomenon of static electricity is by the judicious use of Christmas tree tinsel, and we would strongly recommend the same to others who have experienced difficulty from this source.

Method of Speeding Up Inventories

Many plants that package their product before shipping find an inventory of the supply of finished goods to be a long, expensive and wearisome affair. One way to shorten such inventories and make them less difficult is to have each different weight of goods and each different product in a different colored package. It also helps with shipping operations if the shipping cartons are labelled in the same colors.

Spur Gear Speed Reducers for Increasing Speeds

By Francis A. Emmons

Foot Bros. Gear & Machine Co.,
Baltimore, Md.

As a rule commercial prime movers operate at higher speeds than the machines or equipment which they drive. There are, however, some instances where it is desired to drive equipment at higher speeds than the motor or engine used as the source of power and in such instances provision must be made for stepping-up the speeds of the prime mover by some intermediate equipment.

At first thought it might appear that a speed reducer could be used in every case to increase speeds by simply reversing the connection, in other words, connecting the slow-speed shaft to the shaft of the prime mover instead of connecting it to the high-speed shaft. But there are certain limitations to the use of spur gear speed reducers for increasing speeds due to the extremely high torque which must be developed by the prime mover to start the driven unit, particularly where the ratio of speed increase is large.

Theoretically the same horsepower as is delivered to a speed reducing unit is

delivered by it to the driven unit. In practice however allowance must be made for the frictional and other losses, within the reducer itself. These losses range in spur gear reducers of different designs from 5 to 15 per cent.

The formula for horsepower delivered by a spur gear reducing unit is:

$$hp. = \frac{P \times \pi DN}{33,000 \times 12} \quad (1)$$

Where

P = Load in pounds on slow speed shaft.

$\pi = 3.1416$.

D = Diameter in inches of gear on slow-speed shaft.

N = r.p.m.

Torque is expressed by the formula

$$T = P \frac{D}{2} \quad (2)$$

Therefore, substituting equation (2) in equation (1)

$$hp. = \frac{\pi TN}{33,000 \times 6} = \frac{TN}{63,025} \quad (3)$$

and

$$T = \frac{63,025 \times hp.}{N} \quad (4)$$

If we assume that horsepower delivered by the reducing unit is the same as that delivered to it, theoretically correct, we have

$$(hp.) = \frac{TN}{63,025} =$$

$$(hp.)_2 = \frac{T_2 N_2}{63,025} \quad (5)$$

or

$$\frac{TN}{63,025} = \frac{T_2 N_2}{63,025} \quad (6)$$

$$TN = T_2 N_2 \quad (7)$$

$$\frac{T}{T_2} = \frac{N_2}{N} \quad (8)$$

which means that the torque and speed are inversely proportional when frictional and internal losses are disregarded.

Thus it will be apparent that when using a spur gear speed reducer for increasing speeds, a high torque must be applied at slow-speed end to develop the necessary horsepower at the high-speed end.

This applies of course to other forms of transmission equipment such as pulleys and belts, chain drives and open gearing. For high ratios the torque increases and it is necessary to provide excessive power at the slow-speed end to make it possible to start the driven unit.

The process of increasing speeds with any form of transmission equipment may be compared to the efforts of a man trying to use a lever to lift a weight but with the fulcrum at a point near his hands. It is clearly apparent that as the fulcrum is brought nearer to the end at which the force is applied the force that has to be applied to lift the weight increases. This increase in force corresponds to the increase in torque required to increase speeds at higher ratios.

For low ratios, where the ratio does not exceed 12 to 1, speed reducers may be successfully used as speed increasers.

Some types of commercial gasoline engines, steam engines and synchronous motors operate at comparatively low speeds and where they are used for direct drive of rotary pumps, compressors, fans and similar equipment, speed reducers offer a compact, efficient and safe means of transmitting power and stepping-up the speeds.

Portable Pump Set Useful for Transferring Liquids

A pump that can be picked up either by hand or by conveyor and carried from point to point at which a small amount of pumping is required can sometimes be used to great advantage. In one leather plant, for instance, such a unit is found to perform excellently in the department where the hides are limed.

In this operation there is need of changing the liquor, containing a lime sludge, from pit to pit at intervals of approximately a day. A very large number of pits are used. Instead of running the necessary pipe lines for a central pumping station use was made of an overhead crane and of "homemade" apparatus. (Two or three men could readily displace the crane were it lacking.)

Upon a lightweight wooden platform, designed to rest securely on the shoulders of the tanks at the points where it is to be used, a centrifugal pump with direct connected motor is mounted. Long, heavily insulated leads are used for supplying current. The only other equipment in this particular case is a rubber hose used on the suction side. The outlet of the pump is faced in the direction of the tank to which the liquor is to be transferred.

Non-Sticking Valves for Caustic Solutions

The difficulties of stopcocks sticking when used in systems handling caustic solutions has been solved by the General Electric Co. by the use of Genelite as a facing for the rotating part of the valve. Among the properties of the material are that it never seizes or flows and that it is self-lubricating to a certain extent.

Considerable trouble was experienced with valves in the oxygen and hydrogen producing plant of the company. Valves stuck, and needed to be disassembled and sometimes destroyed after they had been used in caustic systems. Valves with Genelite facings were found to operate freely after 18 months of service. Such units can be used with practically any solution that will not attack bronze.

Genelite is a synthetic bronze, having uniformly distributed throughout its mass approximately 40 per cent by volume of very finely divided graphite. It was developed in the research laboratory of the General Electric Co. a few years ago as an improved bearing alloy. Although the material has the appearance of bronze, it is machined with difficulty; it can, however, be ground easily. High pressure and heat are used in molding it.

Chemical Engineering Equipment Exhibited at Providence

Exposition of the Association of Chemical Equipment Manufacturers, Held in Conjunction with the Spring Meeting of the A.I.C.E. Attracted Wide Attention from Industrial Executives

Editorial Staff Report

DURING the week of June 22 to 27, in conjunction with the semi-annual meeting of the American Institute of Chemical Engineers, an exposition of chemical engineering equipment was held in the State Armory at Providence, R. I., by the Association of Chemical Equipment Manufacturers. This exposition was quite novel in character, since it was confined solely to the showing of equipment, no products being shown, and also because attendance was confined to engineers, industrialists and others directly interested, the general public being excluded.

In the face of this latter restriction, the attendance was naturally rather small. There were, however, many men prominent in the field included among the visitors. Some companies even went to the length of sending all of their responsible executives. The success of this type of exposition, nevertheless, cannot be determined at this time. Several months must elapse before the exhibitors will be able to fairly state just what they got out of it.

WELDING EQUIPMENT SHOWN

Among the most interesting exhibits were the welding equipments shown by the General Electric Co. and the Oxweld Acetylene Co. The G. E. exhibit included one of the new automatic arc welding devices, a machine much like a machine tool in appearance, in which the work to be welded is held firmly in

place while a welding head moves along it. The electrode is fed out automatically as the head moves forward and the

tains gas regulating and protective devices and an automatic carbide feed control. Generation of the first acetylene causes water to rise on this side of the partition high enough to all but submerge a pan full of water, hung to a control lever. This pan normally acts as a weight acting counter to a spring, but as the water rises about it, its effective weight is diminished and the carbide hopper valve is closed by the spring. As acetylene is drawn off, water rises in the gas compartment and correspondingly lowers under the

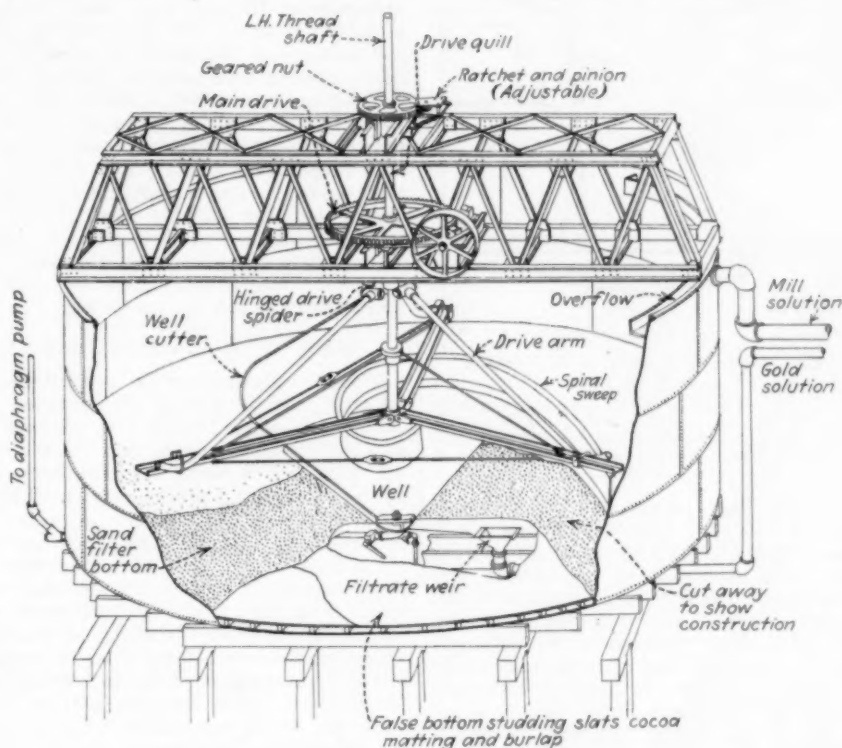


Fig. 2—Outline Drawing of Hardinge "Superthickener"

The details of this design, as described in the text, will be noted in this drawing. Also note the well cutter, which revolves with the sweep and keeps the well open

whole is regulated to operate at just the proper speed to form a weld of the correct dimensions and strength. This device is designed particularly to fit the needs of those who must fabricate metal drums, cans or tanks for use as containers. This same company also exhibited a portable electric welding set, mounted on a wheeled truck, which makes electric welding available anywhere about the plant that current can be obtained.

Oxweld Acetylene Co. demonstrated at their booth the use of oxyacetylene welding for making chemical engineering equipment on a commercial scale, for fabricating small sized equipment for use in experimental work and for the welding of metals other than steel or iron, such as aluminum and copper. This company also exhibited a portable acetylene generator of small size for producing acetylene for welding and cutting. This generator, shown in Fig. 1, takes 35 lb. of carbide per charge. Empty, it weighs 210 lb. As shown in the figure, a vertical partition extends nearly to the bottom, into a water seal. One side is gas tight and contains the carbide hopper at the top. The upper part of the other side con-

float, relieves some of the buoyancy under the pan, depressing the spring and allowing a small amount of carbide to drop into the generator and restore equilibrium conditions.

DEVICE FOR THICKENING

Among the new developments, perhaps the most attention was given to the so-called "superthickener" put out by the Hardinge Co. This device which is shown clearly by the outline drawing, Fig. 2, is suitable for filtering and clarifying operations, as well as for thickening. The figure, which represents a 30 ft. diameter unit 12 ft. high, shows a 6 in. false bottom consisting of studding, slats, cocoa matting and burlap. This supports a bed of fine sand. A superstructure across the top of the tank carries the actuating mechanism. This consists of a worm-gear-driven quill or torque tube, through which passes a left-hand threaded shaft feather-keyed to the quill and rotating with it. The threaded shaft protrudes through the quill and to its lower end is attached a steel-shod spiral sweep, the end of which just clears the inner wall of the tank. The spiral is caused to revolve by drive arms attached

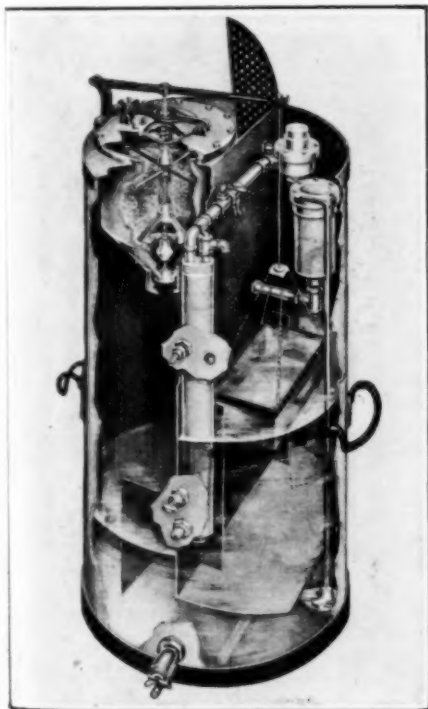


Fig. 1—Acetylene Generator of Small Size
This portable unit generates the gas for welding and cutting operations

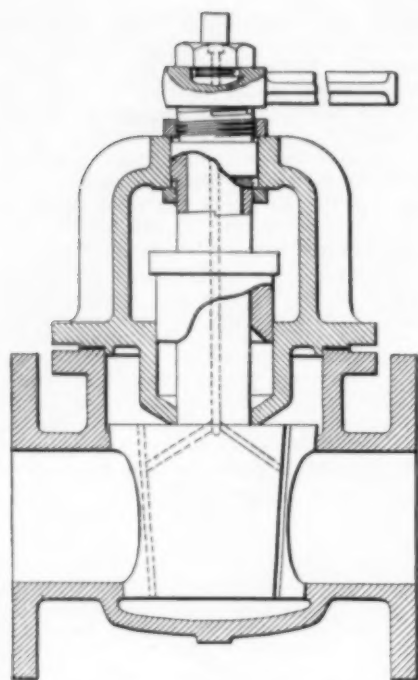


Fig. 3—Positive Lift, Free Turning Acid Plug Cock

This valve, made of alloy bronze, is recommended by its manufacturers for use with such commercial acids as sulphurous, sulphuric, hydrochloric, acetic and tartaric

through hinged joints to a spider casting on the quill. The threaded shaft engages a geared nut riding on top of the quill, and this nut supports the weight of the threaded shaft and the spiral sweep. At every revolution of the quill, a ratchet-and-pawl actuated pinion revolves the geared nut sufficiently to lower the spiral sweep a measured distance into the bed of sand in the tank. In this way all settled material as well as a very thin film of sand is removed at each revolution of the mechanism. The length of thread on the shaft is 5 ft. so that a 5 ft. deep bed of sand can be cut away before renewal. The liquid, after the settled material has been caught by the sand bed, flows through the sand and the false bottom, and so out. The sand and the settled material is swept into the cone-shaped well in the middle and leaves via this well and the underflow outlet.

EMULSIFIER AND COLLOID MILL

Due to the current interest in processes that involve the working of material in dispersion the new emulsifier and colloid mill shown by the Chemical Construction Co. was a center of much discussion. This device has been designed to provide a more rugged machine that operates at a slower speed than other devices of this nature previously brought out. It embodies but two main parts, only one of which moves. These are a heavy cast steel casing, which is stationary and a cast steel rotor. These are both ground to fit with a slight taper on one so that adjustment of the clearance and hence the particle size can be obtained by advancing or retreating the rotor in its relation to the casing. The inner periphery of the casing and the outer periphery of the rotor are each pro-

vided with many grooves cut parallel to the axis of rotation which serve to form teeth on each surface. Action of the mill is due to the shearing and disintegrating forces set up by the material being forced through the minute clearances between these two sets of teeth. The mill exhibited was designed to operate at 3,000 r.p.m. and each surface was provided with 72 teeth, thus giving over 200,000 shearing actions per minute.

Another device that was new at this exhibit was an acid plug cock called the "PLFT" put out by the American Manganese Bronze Co. The initials stand for positive lift, free turning, and the valve was designed to provide an easy opening and positive closing plug cock that would be suitable for use with commercial acids such as sulphuric, muriatic, acetic, malic, tartaric and sulphurous acids. The feature of the valve is an arrangement which raises the plug slightly when the valve is being opened and forces it down tightly into its seat when the valve is closed. This construction is evident from the drawing shown in Fig. 3.

AN UNUSUAL CARBOY BOX

The Horatio Hickok Co. exhibited the "Smith" carboy box, a new method of carboy packing. In this box the carboy is held in place, as shown in Fig. 4, by means of heavy cork stoppers, 16 at the sides and 8 at the bottom. These cork cushions are set in holes bored in the wedge-shaped side stays and in the bottom and are then paraffined. The carboy is held so firmly by the side corks that there is no danger of its being displaced during shipment. These cushions are located so that they are only in contact with the carboy on the bottom, near the rim and at the shoulder, which are the points of greatest strength. This box is said to save 10 lb. over any other on the market.

The Industrial Conveyor Co. displayed a woven wire belt of high flexibility, in view of its strength, which is designed for use as a conveyor, particularly in connection with the continuous feeding of automatic machines. A model was shown in which this belt was used for moving material through an embossing machine. Other similar applications to the artificial fabrics, leather, dyeing and food products industries are suggested.

ACID PROOF BRICK AND CEMENT

Maurice A. Knight exhibited, in addition to his well-known acid-proof stoneware, a line of acid-proof brick and cement, suitable for tank and tower construction and linings. These brick have been available for some time, but recently have been applied to the construction of the "Hurt" acid concentrator, in which the brick are ground and, with the aid of the cement, give a joint that is exceptional for its strength and freedom from leaks.

The Leonard-Rooke Co. put forward a line of equipment which has not heretofore been pushed to any extent in the chemical engineering industries. This consisted of thermostatic mixing valves for water and water temperature control apparatus. This equipment has given good service in other

industries in the past and it is probable that many applications will be found for it in the chemical field.

CONTROLLING DEVICES

Temperature pressure and other controlling devices were well represented by the displays of the Bristol Co., Charles Engelhard, Inc., and Leeds & Northrup. Among the devices shown of particular interest was a system of tunnel kiln control put out by Charles Engelhard, Inc., using electric resistance thermometers placed in the proper locations in the kiln, recording on a recorder the temperature at these points and, through the operation of either solenoid or mechanically operated automatic control valves, so regulating the fuel supply as to maintain the temperature at a predetermined level at each of the points in the kiln at which the thermometers are placed.

This same concern also exhibited an SO_2 meter in which the gas samples are led through an analyzer which in turn actuates a standard recorder unit and registers the content of SO_2 in any gas within 1 per cent.

Automatic temperature controls for high temperatures and for low temperatures, respectively, were the features of the Bristol Co.'s exhibit. In addition, they displayed a large selection of their full line of indicating, recording and control devices for industrial use.

The Leeds & Northrup booth featured electrical measuring instruments for the determination of the acidity or alkalinity of solutions and for measuring the electrolytic conductivity of electrolytes. Apparatus for recording and controlling pressure and temperature in industrial processes were also shown.

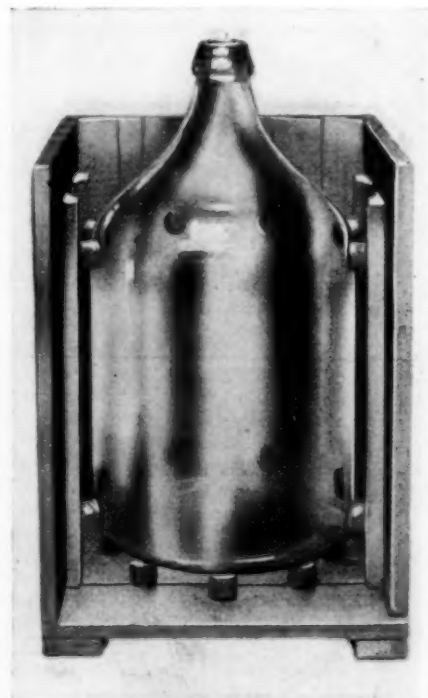


Fig. 4—Carboy Box of Unusual Design

The cork plugs, placed so as to come at the strongest points of the carboy, hold the bottle firmly in place and cushion it from the shocks of transportation

Equipment News

From Maker and User

Speed Reducers

A new line of vertical worm gear speed reducers, for driving such devices as mixers, agitators, stirrers, conveyors, etc., has recently been brought out by Foote Bros. Gear & Machine Co., Chicago, Ill.

These reducers are similar to the standard horizontal reducers except that the casing is designed to be mounted on its side with driving shaft to the right, and the slow speed shaft in a vertical position, extending either up or down as conditions may require. The shafts revolve in phosphor bronze sleeve bearings, while the wheel shaft has ball thrust bearings to take up thrust from the driven machine.

Sizes are made up to 100 hp. and in ratios from 7 to 1 up to 120 to 1.

Electric Welding

A line of automatic arc welding equipments is now being marketed by the General Electric Co., Schenectady, N. Y. These outfits are particularly designed for the production of such products as tanks, boilers, cans and pipe, with special usefulness in tanks where the static load is not over 10 lb. per sq.in. and the metal not less than 16 gage. The complete outfit consists of automatic welding head, control panel, travel carriage and clamping device.

This same company has also recently put out an engine driven welding set of portable type. It consists of a standard WD-12 welding generator driven by a Buda gasoline engine, all mounted on wooden skids. The engine is of 22.5 horsepower rating.

Starting Switch

A push button operated oil switch for starting squirrel cage induction motors directly across the line, called the "Type ZO," has recently been brought out by the Electric Controller & Mfg. Co., Cleveland, Ohio. This switch can be controlled from one or more push button stations located as desired. In this switch an overload device is provided which protects the motor against injury.

The oil tank is drawn from a single piece of sheet steel. The tank latches are arranged so that the tank can be lowered and left suspended to catch oil dripping from the contacts while the switch is being inspected. On account of creepage of oil due to capillary action and from a slight splashing when the magnet surfaces engage, all moving parts are lubricated, thus protecting the switch from corrosion when installed in corrosive atmospheres. The dimensions of this switch are 13 in. high by 9 in. wide.

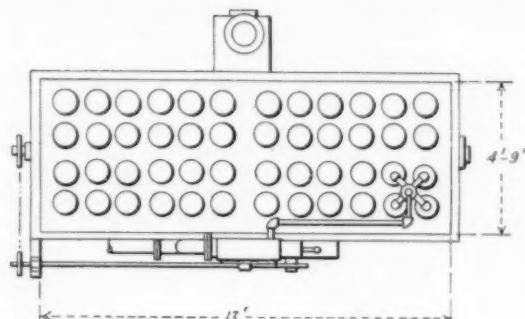
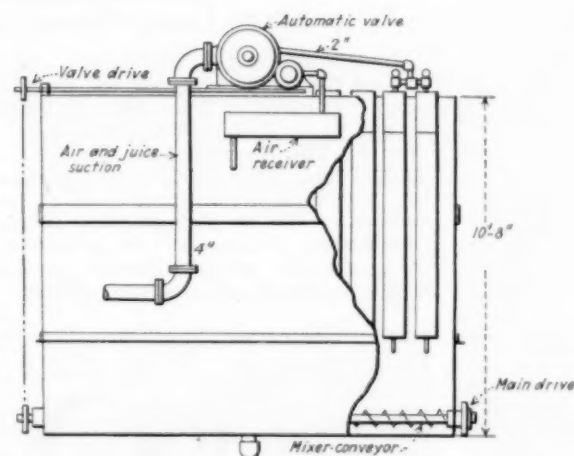


Fig. 1 — Oliver-Borden Thickener or Vacuum Clarifying Filter

In this sketch is shown the equipment used in tests at Oxnard, Calif. The construction is typical of that used for other purposes mentioned in the article



Automatic Clarifier Or Thickener

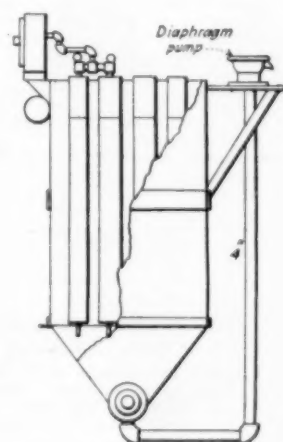
A recent report on the automatic filtration of carbonation juice in beet sugar factories, made by the Oliver Continuous Filter Co., San Francisco, Calif., calls attention to the successful operation of the Oliver-Borden Thickener. This device, which is in reality a clarifier, save-all, or continuous filter, was first tried out in beet sugar factories using the Steffen process of molasses treatment and situated at sea level, where it was used in connection with Oliver continuous filters, by means of which the sludge from the Oliver-Borden Thickener was reduced to cake form and washed to a low sugar content. More recently it was tried out at a beet sugar plant at 5,000 ft. elevation above sea level, in which Oliver filters had already been used for treating a sludge obtained by other means. The thickener is also recommended by its makers for such operations as clarifying wash water from gas plants, gun-cotton decantations and waste water from paper mills.

Its construction is shown in Fig. 1. It consists of a steel tank of rectangular shape, about 11 ft. deep, with a V-shaped bottom in which is a scroll conveyor serving also as a mixer. Suspended in this tank, vertically, are a number of tubes, each tube being

10 in. in diameter at the top and 9 in. at the bottom and 7 ft. long. The entire surface of these tubes, except the heads, is perforated with $\frac{3}{8}$ -in. holes on $\frac{3}{8}$ -in. centers. Around each tube is a covering of filter cloth, wrapped with wire as on an Oliver filter drum.

Depending on the size of the unit, the tubes are arranged in groups of 1, 2, 3 or 4. The interior of each tube or group of tubes is connected by means of a header pipe to a valve mechanism that automatically applies either suction or positive air pressure to the tubes. In conjunction with the valve and acting in synchronism with it, is an automatic blow-timer for the control of the application of the air. Auxiliaries in the shape of a dry-vacuum system and a supply of compressed air are connected to the above. An air receiver is placed in the air line, close to, and immediately ahead of the blow-timer, the pressure in this receiver being controlled by an air pressure regulator. A diaphragm pump, located near the top of the thickener tank, sucks from an outlet in the center of the bottom of this tank. The automatic valve, blow-timer, mixer-conveyor and pump are all chain driven from a $\frac{1}{2}$ -hp. motor. An overhead trolley is provided to facilitate the removal of tubes from the tank.

In operation, the tank is kept full of the liquid being clarified, the level being kept constant by feed regulation



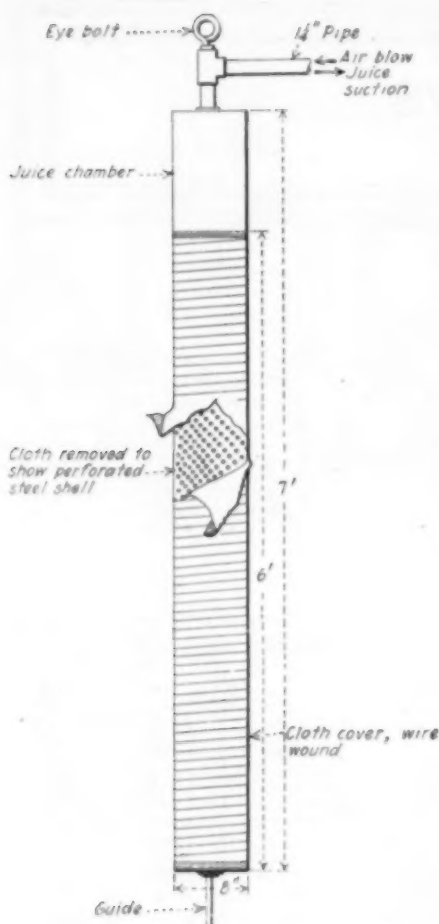


Fig. 2—Sketch of Single Tube From Thickener

This shows the extent of that part of the tube which is perforated, also the method of applying the filter cloth

and an overflow weir. This overflow also takes care of excessive foam, when present, by allowing it to return to the feed pump, where it is broken up and returned to the tank. The level in the tank is high enough to completely submerge the tubes. Suction is applied through the automatic valve to the interior of these tubes, which act as a number of individual vacuum filters. Clear filtrate is thus caused to flow into the tubes while the suspended matter deposits as a cake on the outside. At regular intervals, the suction on each tube or group of tubes is cut off by the automatic valve and air pressure is suddenly applied by means of the blow-timer. This reverses the

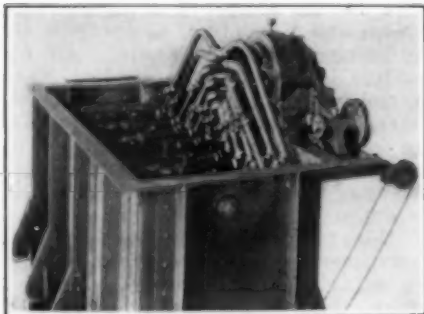


Fig. 3—View of Top of Oliver-Borden Thickener

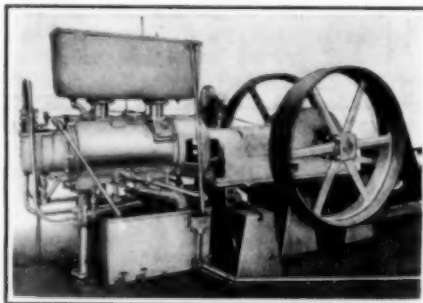
In this picture the method used for connecting the tubes to the automatic valve is shown as is also the valve and its drive

action and causes the cake on the outside of the filter cloth to drop to the bottom of the tank, where it is mixed into a thick sludge and conveyed to the outlet by means of the scroll conveyor. By means of the head of liquid in the tank and the suction of the diaphragm pump, this pulp or sludge is discharged in a continuous flow. By manipulation of the air vent on the pump, the amount of this discharge is regulated, the density of the sludge varying inversely as the rate of flow.

Clarifying carbonation juices by the use of this equipment is claimed to give the following advantage: Saving of filter-cloth, saving of labor, high purity of filtrate, less sugar in filter lime cake, hence less water needed for lime cake, hence less water to evaporate, cleaner evaporators, more agreeable working condition and hence less labor turnover, and a cleaner filter station.

Four-Stage Compressor

A new four-stage, horizontal compressor, for compressing air and various gases to pressures from 2,000 to 5,000 lb. per sq.in., has recently been developed by The Norwalk Co., South Norwalk, Conn. This machine is designed for universal application and it is claimed to be so proportioned in its compressing stages as to be adaptable to practically all commercial service within the range of pressures stated.

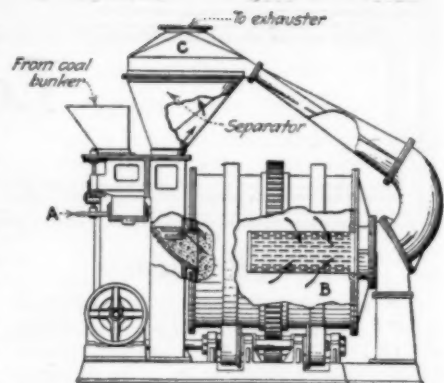


Four Stage Horizontal Compressor

This machine, of simple and compact design, has been especially built to compress gases up to 5,000 lb. per sq.in. and deliver them at room temperature.

Because of the four stages and the high efficiency of inter-cooling between stages, the temperature of the compressed gas is maintained at a low point at each stage and the gas is delivered close to room temperature. This low temperature is of particular value in handling such gases as oxygen, hydrogen and acetylene, as it reduces the hazards greatly.

The compressor, known as Type TB-S4T, has also been designed for simplicity and compactness, as can be seen from the accompanying cut. It is also easily accessible. By removing the final stage water jacket and cylinder head, all interior cylinder operating parts are exposed. The inter-coolers are open tanks containing accessible coils. The valves used are Norwalk ring-plate valves. Special attention has been paid to balancing the machine, preventing racking and increasing its life.



Partial Section of Unit Pulverizer

This mill is of a simple, slow speed type and is for the direct firing of boilers and other types of furnaces

Unit Pulverizer

A ball mill and separator unit for preparing powdered coal for direct firing, shown in outline in Fig. 1, has recently been brought out by the Bonnot Co., Canton, Ohio. Referring to the figure, the coal is fed to the mill by a slow speed disk feeder, regulation of supply being by control wheel at A. On reaching the mill, the coal is reduced in size by the cascade of balls as the cylinder rotates. The speed is slow, a 1 1/2 ton mill operating at 30 r.p.m.

The mill cylinder is lined with rolled steel bars or with Linerite (a rubber lining), as desired. Preliminary classification is performed within the mill by means of the perforated steel pipe B, through which outlet is given to the separator C. A current of air from the exhaustor takes the coal that has reached sufficient fineness in the mill out through B to C, where the oversize particles are separated out and returned to the mill, the fines going on to the exhaustor and so to the burner.

Locomotive Crawler Crane

A locomotive crane of the crawling tractor type and of 10 tons capacity has just been placed on the market by the Industrial Works, Bay City, Mich. This machine, while similar in appearance to the crawler cranes previously produced by this company, as can be seen from the accompanying photograph, has been redesigned and many new features added.

The driving gear has been improved and now works through friction clutches, each tread independent of the other. Speeds have been increased. These improvements, among others, make the new design well adapted for speedy and close maneuvering.



Locomotive Crawler Crane

Electrical Equipment

With the marketing of a new type of direct current motor and a redesigned type of alternating current motor, the General Electric Co., Schenectady, N. Y., is now manufacturing a completely revised line of general purpose motors. This line includes all standard speeds and horsepower ratings for use on any standard circuit.

Standard on all these motors is the steel shell, babbitted bearing, but the makers are also prepared to furnish ball bearings on many motors for those who prefer that type. Also, some of the smaller direct and alternating current motors, rating for rating, are now mechanically interchangeable.

As a result of these changes, the standard lines of general purpose motors are much simplified. Alternating current motors include the KT, MT and SCR types—the SCR, KT-900 and MT-900 having been introduced during 1923. All KT motors utilize the squirrel cage rotor and are constant speed machines for use on polyphase circuits. The MT motors are also for use on polyphase circuits, are constant or adjustable-varying speed and utilize the wound rotor. Single phase motors are covered by the SCR type, these being constant speed machines ranging from $\frac{1}{2}$ to 10 horsepower. The new BD and CD motors comprise the complete direct current line.

An advantage of the standardization of these general purpose motors is the simplification of the renewal parts problem with specific reference to bearing linings manufactured for alternating current types, both single and multi-phase, thus enabling motor dealers to supply bearings for either alternating or direct current motors from the same stock. Most of the bearing linings, also, are interchangeable, a total of about 2,500 ratings listed thus using not more than 23 different bearings.

IMPROVEMENTS IN INSTRUMENTS

The General Electric demand meter, known as the Type G, has recently been changed and improved. The stylus actuating mechanism is now equipped with a totalizing register, thus providing a check on the number of impulses recorded by the demand meter against the reading of the watt-hour meter with which it is coupled. Other changes include the use of a double coil armature construction, to replace the spring return type; use of a three wire type of contact; a modification in armature construction, eliminating any tendency of the stylus to "overshoot," even on appreciable overvoltage; and the use of an adjustable zero stop, so that the sliding pinion will always mesh with the intermediate gear when the stylus resets.

For the purpose of improving the General Electric demand meter register for watt-hour meters bearing the designation M-9, a synchronous motor has been developed to replace the induction disk motor as the timing element. This is said to improve the operation by eliminating timing errors caused by temperature and voltage changes, and to reduce the frequency error. The improved device is designated type M-10.

The General Electric Co. has also made several advances in controlling, starting and similar devices. A new mill type of magnetic time controller for reversing and non-reversing direct current motors is particularly adapted to crane and hoist operation. The hand starting compensators bearing the designation CR-1034 have been redesigned. These are for use on alternating current circuits for starting squirrel cage induction motors. Closer overload protection is expected. A relay resetting function now incorporated in the push button simplifies the operation.

There is also a new lever switch being marketed, called the "LP." In this switch there are no joints in the current carrying portions except at the hinge and the contact clip. There are no soldered or sweated joints in any part of the device. This switch is made in capacities of 30, 60 and 100 amperes. A full line will eventually be available.

HEATING UNIT

A new General Electric immersion heating unit consists of helicoil sheath wire cast into iron. It is designed for use in oil baths and in melting pots for lead, tin and alloys which do not attack iron. These units are being made in capacities up to 5 kilowatts and are sold either individually or incorporated in pots or baths.

Manufacturers' Latest Publications

Sullivan Machinery Co., 112 S. Michigan Ave., Chicago, Ill.—5 new bulletins, as follows: Bulletin No. 80-A describing Sullivan "C" and "CN" mounted Diamond drills for gas engine drive; Bulletin No. 81-E, describing Sullivan "DW-64" water hammer drill; Bulletin No. 81-EA, describing Sullivan "DW-64" hammer drill for channeling or line drilling; Bulletin No. 81-F, describing Sullivan "Rotator" hammer drills; Bulletin No. 81-G, describing Sullivan air feed stopping drills.

Goodyear Tire & Rubber Co., Inc., Akron, O.—The 1925 edition of the Goodyear "Handbook of Mechanical Rubber Goods," being a catalog describing the manufacture and use of such rubber products as belting, hose, sheets, mats, and molded and cut rubber goods.

Esterline-Angus Co., Indianapolis, Ind.—Bulletin No. 425.—A bulletin describing the "Twin-Type" graphic meter, a recording meter which gives two records accurately synchronized as to time.

Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill.—Two new publications one describing various types of Link-Belt portable loaders, and the other, entitled "Book No. 755" describing drop forged rivetless chain for conveyors and elevators.

Engberg Electric & Mechanical Works, St. Joseph, Mich.—Catalog No. 105.—A new catalog, describing direct-current, direct-connected electrical generating sets.

The Griscom-Russell Co., 90 West St., New York City—Form No. 207.—A folder describing mineral seal oil heat exchangers.

Celite Products Co., 11 Broadway, New York City—Bulletin No. 106.—A revised issue of bulletin on insulation of boilers, including additional information on the insulation of powdered fuel furnaces and of stacks.

Asphalt Block Pavement Co., Toledo, O.—A new folder describing a new product produced by this company called copper sand, which is a hard aggregate for the wearing course of concrete floors and pavements.

U. S. Electrical Manufacturing Co., Los Angeles, Calif.—A folder describing the U. S. Automatic Start Motor, a self starting motor with no moving parts in the starting mechanism.

Patterson Foundry & Machine Co., East Liverpool, O.—A new booklet showing in-

stallation photographs of Patterson mills in paint and varnish plants.

Adam Hilger, Ltd., 75-A, Hampton Road, London, N. W. 1, England.—A leaflet describing the Chevenard Dilatometer and the Moll Microphotometer.

C. L. Best Tractor Co., San Leandro, Calif.—A new catalogue describing the construction and use of various types of Best tractors and also a special pamphlet describing the use of these machines in the logging industry.

Republic Flow Meters Co., 2240 Diversey Parkway, Chicago, Ill.—A new, complete catalogue of pyrometers and their application in various industries.

E. Leitz, Inc., 60 East Tenth Street, New York City—Pamphlet No. 1061.—A booklet describing binocular stereo magnifiers for precision examination in control work in industrial plants.

The Permold Co., Cleveland, O.—A folder on aluminum alloys and castings as made by this company.

Griscom-Russell Co., 90 West St., New York, N. Y.—Bulletins Nos. 400 and 402.—Pamphlets describing respectively the "Multiscreen Filter" for straining oil and other foreign matter from boiler feed water and the "Reilly Oil Heater" for preheating fuel oil.

Cochrane Corp., Philadelphia, Pa.—Nos. 1231 and 1247.—Two new catalogs dealing with, respectively: filters for water for all types of industrial plants; and indicating, recording and integrating flow meters for steam and water in pipes.

New Departure Mfg. Co., Bristol, Conn.—Copy of a complete catalog of ball bearings and their application, in loose leaf form, to which supplements or revisions will be issued.

The Superheater Co., 17 East 42d St., New York, N. Y.—A new engineering data book on the generation and use of superheated steam with many valuable engineering tables.

Crucible Steel Co. of America, 17 East 42d St., New York, N. Y.—New 1925 edition of this company's general catalog giving description and specification of their line of special and alloy steels.

The Alexander Milburn Co., Baltimore, Md.—Catalogs Nos. 172A and 199.—Two new catalogs, the first on welding and cutting apparatus and the second on portable acetylene lights for night operations.

Williams Tool Corp., Erie, Pa.—A leaflet describing a new type of die head used on the new Williams "Rapiduction" power pipe machine.

Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.—Catalog No. 10.—A new and revised edition of general catalog on apparatus for capacitance and inductance measurements and magnetic testing.

F. J. Ryan & Co., Philadelphia, Pa.—No. S-4.—A pamphlet describing the Series S-4, Ryan-Mirco low pressure oil burner.

Elwell-Parker Electric Co., Cleveland, Ohio.—Catalog No. 140.—General catalog of Elwell-Parker "Tractors," which are electric storage battery industrial trucks, tractors and cranes.

Crescent Refractories Co., Curwensville, Pa.—Series 1, No. 11.—A data sheet on chimney design.

Raymond Bros. Impact Pulverizer Co., Chicago, Ill.—Catalog No. 17.—General catalog of grinding, pulverizing and separating machinery, showing design and use of this equipment.

Republic Flow Meters Co., Chicago, Ill.—A new pamphlet describing recording pyrometers.

Esterline-Angus Co., Indianapolis, Ind.—Bulletin 525.—Bulletin describing the "Quick Trip" graphic meter, a meter which automatically increases the chart speed during disturbances in the power system.

Steere Engineering Co., Detroit, Mich.—Bulletin No. 41.—A bulletin giving a discussion of water versus steam in water gas manufacture.

The Duriron Co., Dayton, Ohio.—Bulletins Nos. 139, 140 and 141.—No. 139 describes digestion equipment for use in the laboratory with Kjeldahl and other types of digestion flasks, No. 140 describes Duriron exhaust fans for corrosive fumes, No. 141 describes drain pipe and other laboratory equipment of Duriron.

The Alcumite Corp., Dayton, Ohio.—Bulletin No. 1.—A technical description of "Alcumite," an acid resistant metal supplied in castings, sheets, rod and bars.

General Electric Co., Schenectady, N. Y.—Bulletin No. 41521B.—A new catalog of high speed induction motors and frequency changers.

Patents Issued May 26 to June 30, 1925

Paper, Pulp and Sugar

Process of Beating Stuff for the Manufacturing of Paper in Conical Stuff Beaters, as Jordan Engines, Marshall Engines, etc. Anders Emil Ryberg, Drammen, and Peder Christian Schaanning, Christiania, Norway. —1,540,226.

Process of Manufacturing Pulp or Paper. Lewis Miller Booth, Plainfield, N. J. —1,543,663.

Method and Apparatus for Bleaching Pulp. Albert D. Merrill, Watertown, N. Y., assignor to The Stebbins Engineering & Mfg. Co., Watertown, N. Y. —1,541,371.

Cane-Juice-Settling Tank. Charles W. Ruckstuhl, New Orleans, La., assignor of one-half to Leonidas E. Gouner, New Orleans, La. —1,543,621.

Rubber and Synthetic Plastics

Method of and Apparatus for Vulcanizing Rubber. Robert R. Williams, Roselle, N. J., assignor to Western Electric Company, Incorporated, New York, N. Y. —1,543,890.

Method of Vulcanizing Rubber. Raymond Mark Warner, Akron, Ohio, assignor to The Miller Rubber Company, Akron, Ohio. —1,540,580.

Method of Vulcanizing Rubber and Similar Materials. Archie R. Kemp, Towaco, N. J., assignor to Western Electric Company, Incorporated, New York, N. Y. —1,543,926.

Process of Making Chlorinated Rubber. Carleton Ellis, Montclair, N. J., assignor to Chadeloid Chemical Company, New York, N. Y. —1,544,529.

Process and Apparatus for Obtaining Rubber from Latex. Ernest Hopkinson, New York, N. Y. —1,540,885.

Use of Colloidal Sulphur and Latex. Chauncey C. Loomis, Yonkers, and Horace E. Stump, Brooklyn, N. Y., assignors, by mesne assignments, to The Hevea Corporation. —1,543,932.

Process for Employing Water Solutions of Rubber and Articles so Produced. Ernest Hopkinson and Willis A. Gibbons, New York, N. Y., assignors to Revere Rubber Company, Chelsea, Mass. —1,542,388.

Preparations of Lampblack for Use in Compounding Rubber. William W. McMahon, Detroit, Mich., assignor to Morgan & Wright. —1,541,233.

Method and Apparatus for Grinding Hard Rubber. William G. Hoover and Ambrose Dwyer, Akron, Ohio, assignors to The B. F. Goodrich Company, New York, N. Y. —1,542,346.

Cold-Molded Product and Process of Making Same. Carleton Ellis, Montclair, N. J., assignor to Ellis-Foster Company. —1,541,336.

Apparatus for the Production of Artificial Silk and the Like. John Frederick Briggs and Wilfred Yorke, Spondon, near Derby, England, assignors to American Cellulose and Chemical Manufacturing Company, Limited, New York, N. Y. —1,541,104.

Petroleum Refining

Method and Apparatus for Cracking Oils. Joseph George Davidson, Pittsburgh, Pa., assignor to C. H. Conner, New York, N. Y. —1,541,905.

Apparatus for Treating Hydrocarbon Oils. Carbon P. Dubbs, Wilmette, Ill., assignor to Universal Oil Products Company, Chicago, Ill. —1,543,831.

Apparatus for Treating Oil. Gustav Egloff and Harry P. Benner, Independence, Kans., assignors to Universal Oil Products Company, Chicago, Ill. —1,541,553.

Apparatus for Cracking Oil. Gustav Egloff and Harry P. Benner, Independence, Kans., assignors to Universal Oil Products Company, Chicago, Ill. —1,540,934.

Process of and Apparatus for Distilling and Cracking Hydrocarbon Oils. Alfonse H. Heller, Berkeley, Calif. —1,541,140.

Process and Apparatus for Distilling Oils. Hiram J. Halle, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill. —1,540,986.

Treated Carbonaceous Fuel. Gustav Egloff and Harry P. Benner, Independence, Kans., assignors to Universal Oil Products Company, Chicago, Ill. —1,543,833.

Apparatus for Treating Petroleum Oils. Walter M. Cross, Kansas City, Mo., assignor to Gasoline Products Company, New York, N. Y. —1,540,764.

Process of Refining Mineral Oils. William T. Maloney, Olean, N. Y. —1,540,218.

Method of Producing Decomposed Oil Material. Homer Behm, Tulsa, Okla., as-

signor to The American Patent Rights Corporation, Dover, Del. —1,541,243.

Apparatus for Distilling Liquids. Carbon P. Dubbs, Wilmette, Ill., assignor to Universal Oil Products Company, Chicago, Ill. —1,541,210.

Treatment of Hydrocarbons. George Frederick Forwood and John Gilbert Taplay, London, England, assignors to United Kingdom Oil Company Limited, London, England. —1,541,697.

Treating of Hydrocarbon Oil. S. Philip Coblentz, Baytown, and Stewart P. Coleman, Corpus Christi, Tex., assignors to Humble Oil and Refining Company. —1,540,929.

Process of Distillation. Harry Franklin Perkins, Port Arthur, Tex. —1,541,274.

Oil Mixture for Use in Treating Petroleum-Oil Material. Homer Behm, Tulsa, Okla., assignor to The American Patent Rights Corporation, Dover, Del. —1,541,242.

Method of Blending Light Hydrocarbons. Henry Cooney, Sugar Grove, Ohio. —1,543,750.

Still. Max F. De Balligethy, Houston, Tex. —1,542,864.

Apparatus for Treating Bituminous Shale and the Like. Joseph H. Ginot, Denver, Colo. —1,541,135.

Process of and Apparatus for Recovering Gasoline or Other Hydrocarbon Liquids from Natural Gas. Wilbur G. Laird, New York, N. Y., assignor to Henry L. Doherty, New York, N. Y. —1,541,514.

Electrical Dehydrator for Petroleum Emulsions. Harold C. Eddy, Los Angeles, Calif., assignor to Petroleum Rectifying Company of California, Los Angeles, Calif. —1,544,528.

Vaporproof Storage Tank. Arthur E. Sadler, Henrietta, Tex. —1,541,591.

Decolorizing Carbon and Process of Producing the Same. Christian J. Gambel, New Orleans, La. —1,543,763.

Combustion, Furnaces and Refractories

Oil Burning Apparatus. Frank B. Austin, Attleboro, Mass. —1,540,675.

Oil Burner. Arthur E. Bornemeier, Lincoln, and Martin T. Bornemeier, Murdock, Nebr. —1,542,793.

Oil Burner. Otle Clark Kinsolving, Nashville, Tenn. —1,540,633.

Fluid-Fuel Burner. William E. Baker, Erie, Pa., assignor to Webb Engineering Company, Erie, Pa. —1,542,759.

Oil Burner. John R. Flaherty, St. Louis, Mo. —1,542,379.

Oil Burner. George Sawyer, Atlantic, Mass. —1,542,326.

Oil Burner. George J. Carlisle, Niles, Mich. —1,541,788.

Oil Burner. Herman J. Allen, Wichita, Kans. —1,540,672.

Oil Burner. Benjamin F. Mills, Sloux City, Iowa. —1,543,586.

Liquid-Fuel Burner. William Paul Rudkin, Oklahoma City, Okla. —1,542,528.

Oil Burner. Arthur Earl Sweet, Tacoma, Wash., assignor to W. D. Tripple, Tacoma, Wash. —1,543,132.

Fluid-Fuel Burner. Peter Johnson, Seattle, Wash. —1,542,142.

Oil Burner. George A. Diller and Peter F. Peterson, Milwaukee, Wis.; said Peterson assignor to said Diller. —1,541,768.

Crude-Oil Burner. Frederick W. Scheifele, Audubon, N. J. —1,543,796.

Pulverized-Coal Feeder. Archibald S. McMillan, St. Louis, Mo., and George W. Whipple, Cherryvale, Kans. —1,543,936.

Method of Burning Pulverized Fuel and Burner for Pulverized Fuel. Thomas A. Peebles and Bryant Bannister, Pittsburgh, Pa. —1,542,834.

Powdered-Fuel Air Mixer and Feeder. William H. Whitaker, Shelbyville, Ill. —1,541,087.

Method of and Means for Burning Pulverulent Fuels. Edward B. Worthington, Cleveland, Ohio, assignor to The M. A. Hanna Company, Cleveland, Ohio. —1,542,122.

Means for Pulverizing, Feeding, and Burning Fuel. Joe Crites, Evanston, Ill., assignor to Raymond Brothers Impact Pulverizer Co., Chicago, Ill. —1,541,903.

Furnace. Clarence E. Hawke and Boyd M. Johnson, Metuchen, N. J., assignors to The Carborundum Company, Niagara Falls, N. Y. —1,542,552.

Combustion of Fuel in Furnaces. James Stanley Atkinson, Westminster, London, England, assignor to Société Anonyme des Appareils de Manutention & Fours Stein, Paris, France. —1,541,613.

Furnace. John D. Martin, New Straitsville, Ohio. —1,541,648.

Fuel-Gas-Generating Plant. William E. Baker, Erie, Pa., assignor to Webb Engineering Company, Erie, Pa. —1,542,758.

Gas-Fired Over or Kiln. John Henry Marlow, Stoke-on-Trent, England. —1,541,647.

Continuous Kiln and Method of Operating Same. Conrad Dressler, Cleveland, Ohio, assignor to American Dressler Tunnel Kilns, Inc., New York, N. Y. —1,543,830.

Rotary Kiln. Clifford J. Tomlinson, West Allis, Wis. —1,544,504.

Semi-Refractory Heat-Insulating Composition, Products and Processes of Making the Same. Harold T. Coss, Lompoc, Calif., assignor to The Celite Company, Los Angeles, Calif. —1,544,433.

Continuous Kiln. Spencer B. Newberry, Cleveland, Ohio; Andrew W. Newberry, executor of said Spencer B. Newberry, deceased, assignor of one-half to Andrew W. Newberry and one-half to Arthur C. Newberry. —1,541,169.

Inorganic Processes

Gellike Absorbent and Process of Making Same. Robert E. Wilson, Cambridge, Mass., assignor to The Baltimore Gas Engineering Corporation, Baltimore, Md. —1,540,445.

Aluminum Gellike Absorbent and Process for Making Same. Robert E. Wilson, Chicago, Ill., assignor to The Baltimore Gas Engineering Corporation, Baltimore, Md. —1,540,446.

Cupric Gellike Absorbent and Process of Making Same. Robert E. Wilson, Chicago, Ill., assignor to The Baltimore Gas Engineering Corporation, Baltimore, Md. —1,540,447.

Catalytic and Absorbent Material. Robert E. Wilson, Chicago, Ill., assignor to The Baltimore Gas Engineering Corporation, Baltimore, Md. —1,540,448.

Process for the Production of Alkali-Earth-Metal Permanganates. Robert E. Wilson, Leon W. Parsons, and Stanley L. Chisholm, Cambridge, Mass., assignors to The Secretary of War of the United States of America, trustee. —1,544,115.

Manufacture of Iron Oxide. Richard O. Snellenberger, Chicago, Ill., assignor to Iron Oxide Products, Inc., Cicero, Ill. —1,542,968.

Zinc-Oxide-Recovery Process and By-Products Thereof. Oscar Gerlach, La Salle, Ill. —1,541,561.

Lime-Burning Process. Irving Warner, Bellefonte, Pa. —1,542,195.

Treatment of Hydromagnesite. William Stepney Rawson, London, England. —1,543,620.

Preparation of Magnesium Carbonates. Soma Gelléri, deceased, late of Budapest, Hungary, by Felice Gelléri, administratrix, Budapest, Hungary, and Anton Hambloch, Andernach, Germany. —1,540,391.

Process of Producing Alkali-Metal Carbonates. Frederick W. Sperr, Jr., and David L. Jacobson, Pittsburgh, Pa., assignors to The Koppers Company, Pittsburgh, Pa. —1,542,971.

Manufacture of Magnesia from Dolomite. Camille Clerc and Armand Nihoul, Paris, France. —1,541,116.

Preparation of Bauxite. Almer McDuffie McAfee, Port Arthur, Tex., assignor to Gulf Refining Company, Pittsburgh, Pa. —1,543,934.

Process for the Manufacture of Aluminum Chloride. Harry L. Pelzer and Eugene C. Herthel, Chicago, Ill. —1,541,068.

Lithopone and Process of Making Same. James Elliot Booge, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del. —1,540,456.

Process of Recovering Titanic Oxide from Titanium-Nitrogen Compounds. Peder Farup, Vestre Aker, Norway, assignor to Titan Co. A/S., Fredrikstad, Norway. —1,539,996.

Process for the Manufacture of Sodium Sulphide. Lester Albert Pratt and John H. Clarke, Winchester, Mass., assignors to Merrimac Chemical Company, Woburn, Mass. —1,540,711.

Process for the Manufacture of Sulphuric Acid by the Contact Process. Osborne Benzonson, Woburn, Mass., assignor to Merrimac Chemical Company, Woburn, Mass. —1,542,488.

Process of Making an Insecticide and a Fungicide. George Ethelbert Sanders, Annapolis Royal, Nova Scotia, Canada, assignor to Riches, Piver & Co. —1,541,753.

Production of Calcium Arsenates. Domingo Lopez, St. Albans, W. Va. —1,544,250.

Process of Making Vitreous Silica. Levi B. Miller, Lynn, Mass., assignor to General Electric Company. —1,541,584.

Process of Producing Ammonium Nitrate. Lucien H. Greathouse, Clarendon, Va., assignor to Atmospheric Nitrogen Corporation, Syracuse, N. Y. —1,541,808.

Process of Recovering Pure Lithium Salts. Hans Weidmann, Frankfurt-on-the-Main,

Germany, assignor to American Lurgi Corporation, New York, N. Y.—1,544,114.

Method for the Direct Synthesis of Ammonia. Georges Claude, Paris, France, assignor, by mesne assignments, to Lazote, Inc.—1,544,373.

Process for the Production of Ceramic Ware. Richard Sprenger, Berlin-Henningsdorf, Germany.—1,541,869.

Art of Making Zirconium Compounds. Lonnie W. Ryan, Chicago, Ill., assignor to Lindsay Light Company, Chicago, Ill.—1,540,425.

Dyes and Organic Processes

Albumen Dyestuff Compound and Method of Making Same. Oscar Bally, Basel, Switzerland, assignor to the Firm Haco-Gesellschaft A.-G. Bern, Gumligen, Switzerland.—1,543,543.

Blue Indanthrene Dyestuff and Process of Making the Same. Georg Kränzlein, Höchst-on-the-Main, Paul Nawalsky, Ludwigshafen-on-the-Rhine, Martin Corell, Höchst-on-the-Main, Max Albert Kunz, Mannheim, and Fritz Schütz, Höchst-on-the-Main, Germany, assignors to Badische Anilin & Soda Fabrik, Ludwigshafen-on-the-Rhine, Bavaria, Germany.—1,541,156.

Dyestuffs of the Anthraquinone Series. James Baddley and William Wyndham Tatum, Manchester, England, assignors to British Dyestuffs Corporation Limited, Manchester, England.—1,540,733.

Wool Dye of the Pyrone Series. Georg Köhres, Leverkusen, near Cologne, Germany, assignor to Farbenfabriken vorm. Friedr. Bayer and Co., Leverkusen, near Cologne-on-the-Rhine, Germany.—1,543,166.

Monoazo Dyestuff. Karl Thies, Lindlingen, near Hoechst-on-Main, Germany, assignor to Farbwerke vorm. Meister Lucius & Brüning, Hoechst-on-Main, Germany.—1,540,664.

New Dyestuffs and Process of Making Same. Jaroslav Fröhlich, Basel, Switzerland, assignor to Society of Chemical Industry in Basel, Basel, Switzerland.—1,544,441.

Manufacture of Vat Dyestuffs of the Anthraquinone Series. Arthur Lüttringhaus and Philip Kacer, Mannheim, Germany, assignors to Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-Rhine, Germany.—1,544,095.

Aminoalkylaminophthalene Sulphonic Acids. Johann Huisman, Wiesdorf, near Cologne, Walter Duisberg, Leverkusen, near Cologne, and Winfried Hentrich and Ludwig Zeh, Wiesdorf, near Cologne, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,543,569.

Trisazo Dye. August Leopold Laska and Arthur Zitscher, Offenbach-on-the-Main, Germany, assignors to Corporation of Chemische Fabrik Griesheim-Elektron, Frankfurt-on-the-Main, Germany.—1,540,485.

Manufacture of Pure 1-Nitro-2-Methyl Anthraquinone. Hans Eduard Fierz, Kilchberg, near Zurich, Switzerland, assignor to Society "Chemical Works" formerly Sandoz, Basel, Switzerland.—1,540,467.

Aminoaryalkyltoluolsulfamid Azodyes. Heinrich Clingenstein, Cologne-on-the-Rhine, Germany, assignor to Farbenfabriken vorm. Friedr. Bayer and Co., Leverkusen, near Cologne-on-the-Rhine, Germany.—1,540,164.

Bis-(2,3-Hydroxynaphthoyl)-4,4'-Diamino-3,3'-Dialkyl-Diaryls. Arthur Zitscher, Offenbach-on-the-Main, Germany, assignor to The Corporation of Chemische Fabrik Griesheim-Elektron, Frankfurt-on-the-Main, Germany.—1,540,510.

Process of Making Aminoalicylic Acid. James F. Norris and Edmund O. Cummings, Cambridge, Mass.—1,542,265.

Process of Preparing Metallic Salts of Dithiocarbamic Acid. Yasujuro Nikaido, Bay City, Mich., assignor to Michigan Chemical Company.—1,541,433.

Process of Producing a Phenolic Condensation Product. Carnie B. Carter and Albert E. Cox, Pittsburgh, Pa., assignors to S. Karpen & Bros., Chicago, Ill.—1,543,369.

Process of Manufacturing Ethylene Dihalides. Walter Bauer, Darmstadt, Germany, assignor to Röhm & Haas Aktien-Gesellschaft, Darmstadt, Germany.—1,540,748.

Production of Esters of Fatty Acids. Ralph H. McKee, New York, N. Y., assignor to Intarvin Company, New York, N. Y.—1,542,513.

Manufacture of Cellulose Ethers. Henry Dreyfus, London, England.—1,542,541.

Art of Purifying Ester Bodies. Matthew D. Mann, Jr., Roselle, N. J., assignor to Standard Development Company.—1,541,430.

Process for the Preliminary Treatment of Cellulose Prior to Esterification. Jean Altwegg, Lyon, France, assignor to Societe Chimique des Usines du Rhone, Paris, France.—1,543,310.

Process for Producing Styrol and its Homologues from Aromatic Hydrocarbons. Iwan Ostromislensky and Morris G. Shepard, New York, N. Y., assignors to The Naugatuck Chemical Company, Naugatuck, Conn.—1,541,175.

Benzoxazolone-5-Arsonic Acid. Ludwig Benda, Mainkur, near Frankfurt-on-the-Main, Germany, assignor to Leopold Cassella & Co. Gesellschaft mit beschränkter Haftung.—1,543,544.

Manufacture of Bismuth Tartrates. Gustav Glemsa, Hamburg, Germany, assignor to C. F. Boehringer & Soehne G. m. b. H., Mannheim-Waldhof, Germany.—1,540,117.

Process for Obtaining Vinyl Chloride from Acetylene. Iwan Ostromislensky, Locust Point, N. J., assignor to the Naugatuck Chemical Company, Naugatuck, Conn.—1,541,174.

Process for the Manufacture of Nitrogenic and Phosphatic Combinations. Joseph Breslauer and Georges Darier, Geneva, Switzerland, assignors to Société d'Etudes Chimiques pour l'Industrie, Geneva, Switzerland.—1,542,986.

Process of Making Acids from Aromatic Hydrocarbons. James Flack Norris and Everett W. Fuller, Cambridge, Mass.—1,542,264.

Process of Manufacturing Hydroquinone. Hermann Emde, Berlin-Lankwitz, Germany, assignor to Chemische Fabrik auf Aktien (vorm. E. Schering), Berlin, Germany.—1,540,738.

Coumarone-Indene Resins and Process of Making the Same. Harry Clifford Karns, Philadelphia, Pa., assignor, by mesne assignments, to The Koppers Company, Pittsburgh, Pa.—1,541,226.

Process of Manufacturing Artificial Turpentine. José B. Illas, Habana, Cuba.—1,543,570.

Catalytic Oxidation of Secondary Alcohols. Alfred A. Wells, Montclair, N. J., assignor, by mesne assignments, to Seth B. Hunt, trustee, Mount Kisco, N. Y.—1,541,545.

Method of Producing Nitrocellulose Explosives. Walter Philip Regestein, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,540,424.

Process of Obtaining Sulphonated Products of Wool Fat. Oliver Herzog, Berlin-Dahlem, Germany.—1,543,157.

Process of Purifying Acetone. Herman F. Willkie, Baltimore, Md., assignor to U. S. Industrial Alcohol Co., Inc.—1,542,538.

Process for Tanning. Otto Schmidt, Ludwigshafen-on-the-Rhine, Germany, assignor to Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,539,517.

Process of Tanning Hides. Frederick C. Atkinson, Indianapolis, Ind.—1,538,504.

Method of and Liquor for Producing Tanned Leather. Daniel Dana Jackson and Allen Rogers, Brooklyn, and Te-Pang Hou, New York, N. Y.—1,541,819.

Process for the Manufacture of Activated Material. Oscar L. Barnebey and Merritt B. Cheney, Cleveland, Ohio; Josephine B. Cheney, administratrix of said Merritt B. Cheney, deceased; said Josephine B. Cheney, as administratrix, assignor to said Barnebey.—1,541,099.

Electrolytic Cells and Processes

Electrolytic Cell. Joseph Slepian, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company.—1,543,729.

Electrolytic Cell. Frank E. Hartman and Harry Buxton Hartman, Scottsdale, Pa., assignors to Electric Water Sterilizer & Ozone Company, Scottsdale, Pa.—1,541,947.

Electrolytic Process. Charles J. Thatcher, New York, N. Y.—1,544,357.

Electrolytic Apparatus Having Filmed Electrodes. Ralph D. Mershon, New York, N. Y.—1,543,225.

Dry-Cell Battery. Harry M. Koretzky, and Boris H. Teitelbaum, Brooklyn, N. Y.; said Teitelbaum assignor to said Harry M. Koretzky and Israel Koretzky, New York, N. Y.—1,542,705.

Electrolyte for Electroplating Metal with Tin. Frank C. Mathers, Bloomington, Ind.—1,540,354.

Electrolysis of Alkali-Metal Chlorides. Charles F. Vaughn and Ralph E. Gegenheimer, Niagara Falls, N. Y., assignors to The Mathieson Alkali Works, Inc., New York, N. Y.—1,544,078.

Electrolyte for Storage Batteries. Oscar Alfred Olson, Chicago, Ill., assignor to Potent Dry Battery Company, Denver, Colo.—1,543,787.

Electrodeposition of Chromium. Carl Hambuechen, Mount Vernon, N. Y., assignor to Electro Metallurgical Company.—1,544,451.

Alkaline Accumulator. Francis Arthur Freeth and Leslie Alexander Munro, Hartford, England.—1,541,699.

Chemical Engineering Equipment

Drying Kiln. James M. Seymour, Newark, N. J.—1,542,845.

Drying Apparatus. Henry Baetz, St. Louis, Mo.—1,541,889.

Drier. Charles Oscar Ericson, Helmetta, N. J.—1,540,769.

Drier. Harry Raymond Collins, Allentown, Pa., assignor to Fuller-Lehigh Company, a Corporation of Pennsylvania.—1,541,902.

Distillation Apparatus and Process for Producing Acetone. Noel Statham, Hastings-on-Hudson, N. Y.—1,539,966.

Distillation Apparatus. Piero Mariano Salerni, London, England, and Edoardo Michele Salerni, Paris, France.—1,541,071.

Distillation Apparatus. Raymond M. Kelly, Pittsburgh, Pa., assignor to The Koppers Company, Pittsburgh, Pa.—1,541,227.

Method of Separating the Constituents of Gaseous Mixtures. Claude C. Van Nuys, New York, N. Y., assignor to Air Reduction Company, Inc.—1,539,528.

Method of Separating the Constituents of Gaseous Mixtures. Walter Wilkinson, Jersey City, N. J., assignor to Air Reduction Company, Inc.—1,539,450.

Liquefying Gases. Montague H. Roberts, Jersey City, N. J., and Claude C. Van Nuys, New York, N. Y., assignors to Air Reduction Company, Inc.—1,537,193.

Heat Exchanger. Edwin R. Cox, Los Angeles, Calif.—1,542,613.

Heat Exchanger. Kirk K. Wright, Buffalo, N. Y., assignor to R. G. Wright & Co., Buffalo, N. Y.—1,542,978.

Acid-Resisting Alloy. Alvah W. Clement, East Cleveland, Ohio, assignor by mesne assignments, to William H. Smith, East Cleveland, Ohio.—1,540,928.

Acid-Proof Container. Richard T. Griffiths, Akron, Ohio, assignor to The Miller Rubber Company, Akron, Ohio.—1,540,554.

Concentrating Pan. Oystein Jacobsen, Dayton, Ohio, assignor to The Duriron Company, Inc.—1,542,941.

Humidifier. William B. Hodge, Charlotte, N. C., assignor to Parks-Cramer Company, Fitchburg, Mass.—1,540,335.

Air Separator. George Holt Fraser, Brooklyn, N. Y.—1,542,050.

Gas-Separator Apparatus. Charles F. W. Tabler, Tampico, Mexico.—1,539,968.

Apparatus for Cleaning Gas. Walther Mathieson, Chicago, Ill.—1,543,941.

Dust Collector. Francis E. Finch, New York, N. Y., assignor to Ruggles-Coles Engineering Company, York, Pa.—1,542,866.

Continuous Clarifying Apparatus. Frank J. Casablanca and Manuel F. Galdo, Cardenas, Cuba, assignors to The Continuous Clarifier and Settler Co., Habana, Cuba.—1,542,666.

Electromagnetic Separator. Julius Bing, Eisenach, Germany, assignor to the Firm Magnet-Werk, G. m. b. H. Eisenach, Spezialfabrik für Elektromagnet-Apparate, Eisenach, Thuringia, Germany.—1,541,915.

Centrifugal Machine. Bruno C. Lechler, Philadelphia, Pa., assignor of one-half to Fletcher Works, Incorporated, Philadelphia, Pa.—1,543,289.

Wood Grinder. Richard Lang, Württemberg, Germany, assignor to American Voith Contact Company, Inc., New York, N. Y.—1,540,483.

Stone-Grinding Mill. Henri Dourif, Huntington, W. Va.—1,540,258.

Ball or Pebble Mill. Charles L. Carman, Riverside, Calif.—1,541,114.

Method of and Apparatus for Limiting Concentration of Salts in Water in Boilers. Frederick Sargent, Glencoe, Ill., and David S. Jacobus, Jersey City, N. J., assignors to The Babcock & Wilcox Company, Bayonne, N. J.—1,543,727.

Centrifugal Pump. Paul G. Bogdanoff, Bloomfield, N. J., assignor to Bogdanoff-Friedman, Inc., Newark, N. J.—1,540,530.

Emulsifying or Mixing Apparatus. Robert Bertram Best, Kalamazoo, Mich.—1,540,592.

Humidifier. William B. Hodge, Charlotte, N. C., assignor to Parks-Cramer Company, Boston, Mass.—1,542,136.

Oil-Gas-Making Apparatus. William E. L. Calvin, San Francisco, Calif., assignor of one-half to Joseph Vellone, San Francisco, Calif.—1,540,541.

Process of Dealcoholization and Apparatus for Performing the Same. Charles H. Caspar, Philadelphia, Pa.—1,541,789.

Process and Apparatus for Treating Liquid Material. Ernest Hopkinson, New York, N. Y., assignor to General Rubber Company, New York, N. Y.—1,542,939.

Extracting Material. Frederick John Edwin China, Esher, England.—1,541,115.

Absorption Process. Eric Hjalmar Westling, Redwood City, Calif. Filed June 12, 1922.—1,536,463.

Process for Separating Gas From Liquids. Charles F. W. Tabler, Tampico, Mexico.—1,540,963.

News of the Industry

A. I. C. E. Meeting Held at Providence

Committee Reports After Three Years Study of Chemical Engineering Instruction in the United States

The seventeenth semi-annual meeting of the American Institute of Chemical Engineers was held in Providence, R. I., June 23-26 with headquarters at the Providence Biltmore Hotel. There was a registration of about 200 members and guests. Interest in the session centered about the local industries and their chemical engineering problems, with special reference to stream pollution and industrial water supply. The technical program is reviewed elsewhere in this issue. An additional feature of the meeting was the simultaneous exhibition of chemical engineering equipment by the Association of Chemical Equipment Manufacturers.

The local industries of Providence made generous provision for visits to their plants, giving members of the Institute an unusual opportunity to inspect a wide variety of industrial operations. In the textile industry the U. S. Finishing Co. and the Providence Dye, Bleach and Calendar Co. showed the modern methods of bleaching, dyeing and finishing cotton goods, as well as methods of purifying water for industrial use. The manufacture of blankets was seen at the Esmond Mills. The United States Rubber Co. opened its Revere plant where hard rubber goods are manufactured for a wide range of industrial uses. The Standard Oil Co. arranged for an excursion to its Riverside plant. In the metal industries the Gorham Mfg. Co. and the Brown & Sharpe Mfg. Co. showed the fabrication of silver ware, the casting of bronze and the making of machine tools and fine measuring instruments. Powdered coal firing and the manufacture of gas were seen at the plants of the United Electric Railways and the Providence Gas Co. The latter was the subject of an extensive paper by Walter M. Russell at the Cambridge meeting of the Institute in June, 1919, published in *Chem. & Met.*, July 1, July 15 and Aug. 1, 1919. The recovery of calcium sulphate from the manufacture of phosphoric acid, and the manufacture of gypsum building blocks therefrom were seen at the plant of the Rumford Chemical Works. This process was described in considerable detail in *Chem. & Met.*, June, 1925.

The most important item of business transacted during the session was the adoption of the report of the Com-

mittee on Chemical Engineering Education. This committee was appointed at the Niagara Falls meeting in June, 1922, and was directed to study chemical engineering instruction in the United States for a period of three years and at the end of that time to recommend for the Institute's approval those colleges and universities which, in the opinion of the committee, were prepared to teach chemical engineering according to acceptable standards. The report reviewed the committee's work of the past three years and disclosed the basis on which its selection of schools was made. The committee made it clear that there are doubtless other schools in the United States giving acceptable courses, which were not included in the list due to lack of sufficient data and information. The committee recommended that the Institute continue its work and consider from time to time the claims of other institutions to the recognition and approval of the Institute. The schools recommended by the committee were the following: Armour Institute of Technology, Carnegie Institute of Technology, Case School of Applied Science, Columbia University, Iowa State College (Ames), Massachusetts Institute of Technology, Ohio State University, Polytechnic Institute (Brooklyn), Rensselaer Polytechnic Institute, University of Cincinnati, University of Michigan, University of Minnesota, University of Wisconsin, Yale University.

The committee making this report is composed of five representatives from industry and five from educational institutions with H. C. Parmelee as chairman. Those representing industry are W. C. Geer, vice-president, B. F. Goodrich Co.; C. C. Heritage, chemical engineer, National Aniline & Chemical Co.; Arthur D. Little, chemical engineer, Arthur D. Little, Inc.; C. E. K. Mees, Director of Research, Eastman Kodak Co.; W. R. Whitney, Director of Research, General Electric Co. Representatives of the colleges are J. H. James, Professor of Chemical Engineering, Carnegie Institute of Technology, W. K. Lewis, Professor of Chemical Engineering, Massachusetts Institute of Technology; R. H. McKee, Professor of Chemical Engineering, Columbia University; S. W. Parr, Professor of Applied Chemistry, University of Illinois, and A. H. White, Professor of Chemical Engineering, University of Michigan.

The social features of the convention were exceptionally well ordered and added greatly to the success of the meeting. A round of luncheons and

dinners had its climax in a Rhode Island clambake at the Squantum Club—an official evidence of hospitality in that region. At the banquet the Verdandi male chorus of Providence furnished the entertainment and addresses were made by Dr. Arthur D. Little on "The Handwriting on the Wall" and Dr. Maximilian Toch on "The Humorous Side of the Patent Situation." Dr. Little's address will be published in a latter issue of *Chem. & Met.*

Members and guests of the Institute at the Providence meeting are indebted to the local committee for an exceptionally well organized and conducted convention. Under the direction of E. L. Wilson, general superintendent of the Rumford Chemical Works, and Mrs. Wilson, who was chairman of the ladies' committee, the technical and social features of the meeting were made most profitable and enjoyable.

Radium Poisoning Regarded As New Occupational Disease

Two chemists were included among the seven employees or former employees of the United States Radium Co. of Orange, N. J., whose recent deaths have been attributed to a strange occupational disease called "radium poisoning." Dr. Edward D. Leman, who was formerly the chief chemist of the plant, died June 7. The second chemist, Frederick W. Starke of South Orange, died in the Orange Memorial Hospital June 23. The cause of his death was officially reported as acute bacterial endocarditis. It was declared that in an attempt to cure himself of this disease Starke had been in the habit of drinking large quantities of water that had been in contact with the radio-active materials.

The Radium company manufactured a luminous paint which was applied in the plant, for painting numerals on watch and clock dials. It was reported that the employees, who were mostly women, occasionally pointed their paint brushes by drawing them between their lips and it is believed by some that this resulted in the introduction of radio-active material that later caused necrosis of the jaw, pernicious anaemia and other serious body ailments.

The deaths were the subject of a number of controversies among physicians and scientists and several independent investigations have been ordered. The principal one is in charge of County Physician H. S. Marland, who is being assisted by Dr. S. A. von Sochocky, former head of the Orange concern.

News in Brief

Research Fund Established at Indiana University—Eli Lilly & Co., Indianapolis, Ind., manufacturers of chemicals and pharmaceuticals, have given a fund of \$1,200 a year for a period of 5 years to the Indiana State University, for research work in this line, to be known as the Eli Lilly & Co. fund of the Indiana University.

Largest Artificial Gas Plant at Troy—The Hudson Valley Coke & Products Corp., Troy, N. Y., has construction in progress on an artificial gas plant on local site, to be the largest fuel and illuminating gas works in the country. The work is being carried out in connection with a construction program to cost in excess of \$7,500,000, including blast furnace and coke plant. The gas plant will furnish service to Albany, Troy, Schenectady, Watervliet and Rensselaer, and is expected to be ready for operation early in Oct.

Survey for Second Chemical Equipment Exposition—The Board of Directors of the Association of Chemical Equipment Manufacturers, following the successful first Chemical Equipment Exposition in Providence, last month, has directed that a survey be made to secure data for determining where the second exposition shall be held.

Sale of Lime Company—Stockholders of the New England Lime Co., have voted to sell the assets to the recently incorporated New England Lime Company of Delaware. The purchase price was \$2,700,000.

New Orleans Will Have Market for Cotton Oil Futures—Announcement has been made that the New Orleans Cotton Exchange has established a department for trading in cottonseed oil futures. The new department is expected to be in operation on Aug. 1. The contract unit will be 30,000 lb. of loose refined cottonseed oil, and the basis of delivery will be in bulk in storage tanks at New Orleans.

Burnham Chemical Co., Denied Use of U. S. Mails—Through a fraud order issued June 23 at Washington, the Burnham Chemical Co. of Reno, Nev., and G. B. Burnham, president of the company, have been denied the use of the United States mails. The company has been selling stock based on claims of valuable deposits of chemicals controlled by the company at Searles Lake.

French Company to Product Synthetic Ethyl Alcohol—Reports from France are to the effect that the Cie de Bethune shortly will be in a position to deliver on an industrial basis a synthetic ethyl alcohol produced from ethylene at coke ovens and gas plants at a lower price than that for which alcohol obtained from fermentation can be sold. The outstanding difficulty in obtaining low costs is the amount of sulphuric acid required. From 13 to 19 kilos of alcohol are recoverable for each ton of carbonized coal which is twice the amount of benzol recoverable from coke oven gas, says the report.

Chemical Laboratory at University of Pennsylvania—The University of Pennsylvania, has plans in preparation for the erection of a new physiological chemistry laboratory at Thirty-seventh Street and Hamilton Walk, to cost close to \$1,000,000, with equipment. The work will be carried out in connection with an extensive building program at the institution, including an anatomical laboratory, for which foundations are being laid, to cost approximately \$1,300,000; research laboratory for the Towne Scientific School, and other projected structures.

Additional Units for Shale Oil Plant—Three additional units for the shale oil plant of the N.T.U. Company at Casmalia, Calif., are being built by the Bethlehem Shipbuilding Corp. and are expected to be in operation by September. This will give the plant a total capacity for handling 160 tons per day. A 40-ton unit, recently described in *Chem. & Met.*, has been in continuous operation for the better part of the last two years.

Canadian Fluorspar Mine to Reopen—The Consolidated Mining & Smelting Co. of Canada is re-opening its fluorspar mine, on Granby Creek, B. C., which has been closed since the Fordney tariff went into operation. Previously the greater part of the output of this mine was shipped to Gary, Ind., where it was used as a flux in the manufacture of open-hearth steel. It is understood that a contract has been made with steel plants in Ontario to take the output of the mine.

Gas Products Association Convention—The Gas Products Association, the trade association of the oxyacetylene industry, composed of producers of oxygen, hydrogen and acetylene gases, carbide, welding and cutting apparatus and supplies, will hold its Eleventh Annual Convention at The Grand, Mackinac Island, Mich., July 21, 22 and 23.

New Jersey Clay Workers Hold Summer Meeting

The regular summer meeting of the New Jersey Clay Workers Association was held at the Country Club, Trenton, N. J., on June 19, with an attendance of more than 125 members and guests. The morning session was given over to technical discussions, followed by a luncheon, and the afternoon devoted to a visit to the new sanitary ware pottery of the Thomas Maddock's Sons Co., near Trenton, recently completed and now in operation. Fred A. Whitaker, vice-president of the association presided in the absence of Leslie Brown who is president.

The first paper on the program was a "Report of Feldspar Investigations," by R. F. Geller, Bureau of Standards, Washington, D. C., outlining the work accomplished and now going forward in this line at the bureau. The investigations are part of a general program covering important raw materials in the whiteware field; the work has been divided into two parts, one with the trade and the other with the bureau staff. Present activities are being de-

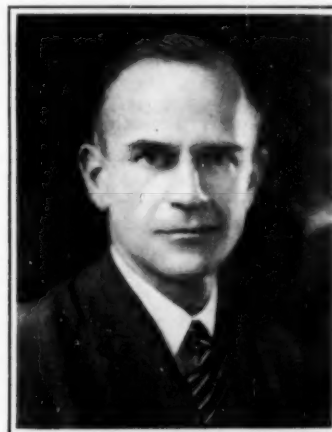
voted to chemical analyses, screen analysis and kindred factors of determination.

An interesting address was delivered by W. L. Shearer, Department of Ceramics, Rutgers College, New Brunswick, N. J., on the subject, "pH Value as a Control Factor in the Preparation of a Casting Slip," covering tests made by the speaker and M. B. Catlin of the same department. The meaning of the symbol "pH" was explained as the hydrogen ion concentration of the solution, with the use of a numeral in connection with the symbol, representing the acidity.

The third and concluding technical feature of the program covered a general discussion of the problems in the manufacture of sanitary ware, led by J. M. Kreger of the Woodbridge Ceramic Corp.

Chemical Engineer Elected President of A.S.T.M.

Walter H. Fulweiler, chemical engineer for the United Gas Improvement Co. of Philadelphia, is the new president of the American Society for Testing Materials, elected at the 28th an-



Walter H. Fulweiler
President A. S. T. M.

nual convention in Atlantic City, June 22-26. The vice-president-elect is H. F. Moore, professor of engineering materials at the University of Illinois, Urbana, Ill.

Mr. Fulweiler, who is well known to the chemical profession as a result of his active participation in A.S.T.M. and other scientific societies, was born in Philadelphia, Jan. 3, 1880. He received the degree of Bachelor of Science in Chemistry from the University of Pennsylvania in 1901. His first position was that of chemist at the Station B plant of the Philadelphia Gas Works. In 1903 he connected with the Kansas City Gas Co. first as cadet engineer and later as plant superintendent. He returned to the Philadelphia Gas Works in 1906 and a year later went to the Department of Tests of the United Gas Improvement Co. He became chief chemist in 1913 and chemical engineer in 1920.

In 1922 Mr. Fulweiler was awarded the Grasselli medal of the Society of Chemical Industry.

News from Washington

By Paul Wooton

WASHINGTON CORRESPONDENT OF *Chem. & Met.*

THE reorganization plan for the Prohibition Unit, which will go into effect August 1, practically has been perfected by General Lincoln C. Andrews, the assistant Secretary of the Treasury. The major objective of the reorganization is the decentralizing of prohibition enforcement. The country has been divided into twenty-two districts where a prohibition administrator will be in immediate charge. Full control will be retained at Washington, however, so as to insure uniformity and co-ordination of the work. It is expected that these administrators because of local acquaintance, will be familiar with the standing of manufacturers using industrial alcohol and, therefore, be in a position to relieve them of some of the burdens in connection with the administration of the regulations. J. M. Doran will continue at the head of the alcohol and chemical division. His authority will be lessened in no way. His supervision of the districts will be such as to insure complete uniformity in the handling of industrial alcohol.

Alcohol Trades Consulted

The Alcohol Trades Advisory Committee was consulted at length in regard to the plan of organization, as have other representative of the chemical industry. So far as General Andrews has heard the new arrangement is entirely satisfactory to the industry.

Despite the fact that the reorganization plan has done practically everything that the proponents of the Cramton bill have been clamouring for, there is some dissatisfaction in that quarter with the new arrangement. The proponents of that measure would like very much to have a bureau of their own in charge of one of their number. The belief is, however, that the plan has recognized everything that they could ask legitimately. The probabilities are that it will make unlikely any attempt to revive a separate prohibition idea at the next Congress.

The extent to which the production of synthetic methanol, on a commercial scale, has stirred the country only now is being realized. Communications reaching the half dozen federal agencies concerned indicate that the effect of this achievement of the Germans has made a profound impression—an impression much more far reaching than would be occasioned by the actual losses involved. It is serving to stimulate research as nothing ever before has done. This applies to all industries as well as to chemical activities, the letters reaching federal bureaus indicate. It has served to put everyone on notice that they must keep on their mettle.

Now that the situation of the wood distillation industry can be appraised more accurately, it has become apparent that its situation is not desperate,

as at first seemed to be the case. This is set forth clearly in a letter which Commerce Secretary Hoover has written Dr. Charles H. Herty, of the Synthetic Organic Chemical Manufacturers' Association. It follows:

"I have been thinking over the statements made to me by you and the representations of the Wood Distillation industry in connection with the situation that has arisen in that branch of manufacture.

"My understanding from you is that some alarm has been created in the minds of the banks who are financing the wood distillation industry, that the synthetic methanol which has been coming in from Germany will totally destroy the wood distillation industry and that, therefore, the industry is having difficulties in financing itself.

"The Department of Commerce has no position in any action that may be taken by the Tariff Commission to adjust the duty to cover the presumed lower costs of producing methanol by the synthetic method, or the intentions of dumping this product in the United States at prices lower than in the countries of origin. These matters, I understand, have been taken up with the two departments concerned.

"As to the credit question, of course the Department of Commerce cannot advise on credits but it would seem to me that the banking public would take account of the fact that methanol is but one of the products of the wood distillation industry and that the economic effect of the decreased price of methanol must be to raise the price of the other products because wood charcoal is a vital necessity for the refining industries and acetate in various forms is a general necessity in industry. It is a certainty therefore that the wood distillation industry is not going to be wiped out.

"I understand that the gross value of methanol sold represents about 20 per cent of the intake of the industry and obviously it can be sold at some price at all times even against any hypothetical synthetic output, so the question is one of ultimate readjustment of prices of the different fractions produced."

Methanol Imports Continue

The imports of large quantities of methanol have caused serious consideration to be given the question whether tariff legislation should not include temporary protection for industries threatened by a foreign development of that character. As one official put it: "We have protected infant industries in the past. The time now appears to have come when we must protect decadent industries to the extent necessary to allow them to adjust themselves to invention or improved practices." There is a feeling, however, that such safe-

guards must be economic rather than legislative. While the agreement with the German wood distillation industry and the fear of violating our anti-dumping law are thought to have operated to keep methanol at a higher price than otherwise would have prevailed, it is pointed out that the average price of the imported product for the first four months of 1925 was 47c. per gal. Imports continue in about the same volume. The low figure for April was due to delays to shipments which caused them to be included in May figures, which as a consequence, were proportionately larger. Sight should not be lost of the fact, it is pointed out, that imports during the first quarter of 1925 were 100 per cent greater than those of the first quarter of 1924.

Fertilizer Association Plans

The new National Fertilizer Association launched its comprehensive program July 1, under the immediate direction of Charles J. Brand, recently chosen as its executive secretary. Emphasis is to be placed on research and public relations, while the soil improvement work, which has been in progress for several years, will be expanded.

Mr. Brand calls attention to the fact that the new association is not the absorption of the Southern Fertilizer Association by the old National association. Both of the old associations were liquidated and the present organization is in no sense a merger. A large amount of work already has been done by the Soil Improvement Committee and individual companies. These committees will be continued as will the University fellowships. Other fellowships will be set up.

Increased attention is to be given research on materials entering into production. Every effort is to be made to devise better and cheaper fertilizers. In this work as well as the economic research the cooperation of consumers is to be sought actively.

One of the major objectives of the new organization will be to encourage the use of fertilizers in the states now making small use of them. The South by reason of its experience in the use of fertilizers rapidly is wresting agricultural supremacy from the other sections of the country. If the North and West are to maintain their land values, it is argued, they must resort to the use of fertilizer so as to increase the per acre yield.

A thorough-going program of trade statistics will be compiled by the association. Work will be done on cost accounting and trade practices which will lead to new efficiencies. It is felt that it is not in the public interest to have the fertilizer industry going around on crutches. For four years it has been limping along and has not been rendering the maximum help to agriculture of which it is capable. The association expects to do all in its power to improve the status of the industry and to make possible the production of cheaper fertilizer. Close relationships will be maintained with the federal government and steps now are being taken to co-operate closely with the state departments of agriculture and the agricultural experiment stations.

Unfavorable Conditions in England Confront Industry

Strike in Coal Trade May Affect Manufacturing Lines—Sugar and Rayon Plants Increase in Number—Priority of Methanol Patents Under Discussion

From Our London Correspondent

INDUSTRIAL conditions, and particularly unemployment figures, are such as to give cause for considerable misgiving. The situation in the coal trade is very serious, both as regards the increasing number of collieries which are closing and as regards the deadlock between masters and men, which may arise during the next month in connection with the wages agreement. The men at present will not listen to any suggestion in regard to the substitution of an 8-hr. for the 7-hr. working day or for any alteration in the rate of wages, which according to the masters, should vary according to the paying capacity of the coalfield in question.

Use of Low-Temperature Retorts

The number of retorts installed or contemplated in this country for the low-temperature carbonization of suitable fuel, waste or otherwise, is increasing and while some of these installations are likely to prove profitable, it appears that development of the "Coalite" process, which has been so much advertised recently, is held up temporarily, probably for financial reasons. The chief difficulty is the heavy capital cost and the cost of upkeep, of a discontinuous retort, coupled with the difficulty of guaranteeing a market for resultant lump fuel. Moreover, the technical details appear to be on an insufficiently sound foundation. Attention has, therefore, been directed to other types of retort, some of which give a granular semi-coke suitable for dust firing or briquetting, and the whole question of "Smokeless Fuel" and also that of utilizing coke for domestic and industrial firing is to be discussed this month at the joint meeting of the American and English Institutes of Chemical Engineers.

In the June issue of *Fuel*, there is described the retort of Dobbelsstein, in which it is claimed to manufacture lump fuel in a continuous manner in a plant, which appears compact, low in capital cost and promising in design. There is reason to believe that this retort will soon be tried out on a commercial scale in this country with suitable modifications, and it seems to constitute the most promising development in this field which has been presented recently. A Dobbelsstein retort of 20 tons daily capacity has been in intermittent operation in Germany for two months.

Manufacturing Plants Increase

The number of sugar factories planned in this country continues to increase, the latest issue being that of British Sugar Manufacturers Co., Ltd., who are to establish a factory in Norfolk to yield ultimately 9,000 tons of sugar annually. Until the industry is established on a firm basis, profits of

such concerns will be derived largely from the Government Subsidy of approximately \$70 per ton, the amount decreasing gradually during the next nine years.

The Rayon Manufacturing Co., Ltd., has been incorporated with a capital of \$1,500,000 to start up a rayon factory near London and in this case, the technical management appears to be adequate and the prospects reasonable. On the other hand, the financial part of the issue is somewhat of the company promoting type, the parent syndicate making large profits by way of cash and shares in respect of services and by the sale of the factory site and buildings acquired for the project.

The recent capital issue guaranteed by the Government in favor of Synthetic Ammonia and Nitrates Limited, a subsidiary company of Brunner Mond, is in a different category and should prove a thoroughly sound investment. The plant at Billingham is to be increased to a total output of 200 tons of ammonia per day, equivalent to 270,000 tons of sulphate per annum. The issue was well supported by the public as compared with recent government issues.

Industrial Developments

Messrs. Howards & Sons, Limited, are expanding their works in connection with the manufacture of new solvents for the soap industry. These are derivatives of cyclohexanol and have the advantage of being readily soluble in soap solution and it appears probable that there is a considerable future for soaps using these solvents. A similar product using coal tar hydrocarbons such as xylene pseudocumene or solvent naphtha condensed with a soap and which can be used with sea water is also being successfully introduced.

The Dunlop Rubber Co. is making good progress and an interesting, though minor, development may be mentioned in regard to the new Dunlop tennis balls. Instead of inflating these balls with compressed air, the process of curing is made to develop sufficient gas to give the standard desired pressure and the behaviour of the balls is very favorably reported.

The process of Filtrators Limited for preventing scale in boilers, is making headway. This is not a chemical process, but consists in circulating the hot boiler water over linseed, the mucilaginous emulsion from which appears to remove scale and to neutralize the effect of lubricating oil without having any harmful effect on the boiler or fittings. The figures as to cost of operation appear convincing and a very important application is in connection with marine boilers, in which, when using the Filtrator apparatus, it is

possible to use sea water as boiler feed until the density reaches a certain limit. The saving in weight and space which would otherwise be needed for carrying fresh water or in regard to fuel for evaporators, appears considerable.

Methanol Patents in Dispute

The position in regard to synthetic methyl alcohol continues to attract considerable interest, and in the *Chemical Trade Journal* there has appeared a statement from the Badische Co., in connection with the prior French patent of General Patart which has elicited a spirited reply from that official. It seems quite possible that Patart's work will prove a potent weapon in diminishing the value of any possible German monopoly in this field, particularly if patent litigation ultimately develops. The situation is not regarded as being so serious in this country as is presumably the case where the wood distillation industry is of greater importance, and it is anticipated that sooner or later arrangements can be made for manufacture in this country. For this purpose, it may be possible to use coke oven gas and the residual gases would then be particularly suitable for the manufacture of nitric acid by the Häusser explosion process, which is now to be developed in Germany on a larger scale than has previously been attempted. The Häusser process lends itself to the installation of small units and it appears logical to use it under favorable conditions instead of oxidizing, with some loss, synthetic ammonia, manufactured in plant involving heavy capital expenditure.

Liquid Soap Specifications Give Difficulty

After successful trials of certain liquid laundry soaps the Government drafted specifications for this commodity with particular reference to certain needs of the Quartermaster Corps and large laundry operations. The specifications prescribed that the liquid soap should contain not less than 12 per cent by weight of a volatile organic solvent, or mixture of such solvents, which must be nonmiscible with water, without objectionable odor, non-toxic, noncorrosive to laundry machinery, and otherwise suitable.

Certain soap manufacturers in attempting to supply this product have apparently misunderstood the character of the organic solvent required and, in one case at least, have used a solvent miscible with water.

In answer to numerous inquiries the Bureau of Standards is pointing out its desire to have the specifications permit as wide latitude as possible on the part of the manufacturer. There is no definite requirement as to the fat or fat base or the specific solvent, but the final performance requirements of the soap must be met. The Bureau has tested one soap which meets the performance specifications satisfactorily; the organic solvent in that case was ethylene dichloride. The Bureau has not determined whether there are other organic solvents equally satisfactory for the purpose or not.

France Makes Progress in Production of Dyes and Chemicals

**Domestic Plants Are Able To Satisfy Home Demands for Dyes—
Output of Acids Has Increased—New Rayon Plants
Established—Progress in Pigments**

From Our Paris Correspondent

THE Franco-German trade convention has not yet been consummated. It appears that the Germans demand very exacting conditions. Their machinery has been remodelled and evidently the competition between the French and German industries will now be keen. It has been said that the Germans intended to set up in France, plants which would turn out dyestuffs of all kinds produced directly from raw materials and not from intermediate products imported from Germany as was the case before the war.

However, this appears quite unlikely. The plants actually existing are quite sufficient and if as forecast the Etablissements Kuhlmann who have put up a building for this purpose in their plant at Villers-St. Paul, are successful in producing vat colors as soon as the end of this year, one cannot easily understand why the Germans would entertain such plans.

Distribution of German Dyes

In connection with this subject it is important to note that the Union des Producteurs Français et des Consommateurs pour le développement de l'Industrie des Colorants en France which was formed following the treaty of Versailles to introduce and to distribute in France the dyestuffs handed over by Germany, has had its status modified. The producers who were members of the Union have all withdrawn. Only consumers are left who have grouped themselves into a Bureau Central d'Approvisionnement en Matières Colorantes de Prestation which has replaced the former Union. The mission of this organization till August, 1928, viz. for a period of three years, is to control the entrance into France of such German dyestuffs as are not as yet made here. No dyestuffs of German origin may enter France without passing through this organization. From this fact the Bureau Central is constantly in touch with the powerful I.G., viz. with Mr. Loewengard whose presence in Paris was previously reported.

The regulations controlling the German importations are the following: firstly, licenses are refused or granted by the Bureau Central arbitrarily; secondly, the products authorized to be imported into France must have an exclusive destination to consumers and cannot be resold; thirdly, for its work and to defray its expenses the Bureau Central puts a 3 per cent tax on all invoices and adds thereto 1.5 per cent for duty and import tax.

Growth of Rayon Industry

On the other hand, the rayon industry which is to a certain extent likewise a chemical industry, offers possibilities of development and remuneration by far more attractive. In this

connection we might note that France, which has been the creator of this industry, is actually left in the background in this field by England, Italy and especially by the United States; the latter producing 40 per cent of the world's consumption. An interesting fact to note is that this fibre does not compete with natural silk but has found markets wholly distinct. This is so true that in Lyons, which is the great French center for natural silk, artificial fibre has seen its own business figures pass from 120 millions in 1923 to 400 millions in 1924 on a total business figure of 2½ billion francs of both kinds produced in Lyons.

Every day sees the creation of rayon companies. One of the more recent is the Celanèse Française with a capital of 55 million francs. It is a branch of the Soie de Tubize. This society, which is actually putting up a plant in Lyons, will fabricate silk with cellulose acetate according to the Dreyfus-Clavel process.

On the other hand, the Société Chimique des Usines du Rhône, one of the greatest French plants of organic products, has put up recently a plant to fabricate acetate silk under the name of "Rhodiaseta" which was turned out first at an average of 100 kilogr. per day and now reaches a daily average of 500 kilogr.

Output of Acids Extended

This increasing industry calls for large quantities of glacial acetic acid and acetic anhydride which have led to the development of the production of these products by synthesis using acetylene as a starting point. Under the name "Acetosynthèse" a new society has just been formed by the Lonza, Kuhlmann and Progil, who make this acid in the plant of Villers-St. Paul.

Other acids less important, such as oxalic acid, formic acid and lactic acid have been produced in France since the war in quantities sufficient to meet French demands whereas before the war these products were largely imported from Germany.

Formic acid is prepared by the Société Normande de Produits Chimiques in its plant of Petit-Quévilly near Rouen after the Goldschmidt process, viz., by fixing carbon monoxide on caustic alkalis, formates are obtained, which are then distilled with acid. With formates heated under given conditions the plant of Progil in Lyons prepares oxalates. It is the modern process of preparation, replacing the former one, which consists in fusing saw-dust and alkali.

The Société Normande de Produits Chimiques also prepares lactic acid at 50 per cent used in the textile industry and especially in the industry of leather. The latter industry also utilize important quantities of bichromates.

The French consumption is about 3,800 tons which before the war were totally imported from Scotland and especially from Germany. Today about half of this is produced in France under the form of sodium bichromate.

Production of Pigments

In the domain of pigments some progress is to be noted. For instance, the production of lithopone, almost inexistent before the war, has taken on a notable development and the Société des Blancs de Communes, which started to fabricate this color in the latter part of 1923, has reached a producing capacity of 4,000 tons per year.

Other white pigments are already prepared in increasing quantities, titan white for instance which offers the great advantage of being inalterable to light, whereas lithopone is quite sensible to it. The Fabriques de Produits Chimiques de Thann et de Mulhouse have organized the fabrication of titan white in their plant of Thann.

Helium Division Will Consist of Five Sections

The helium division of the Bureau of Mines is to consist of five sections. One is to handle work relating to the production, transportation, conservation and analysis of helium-bearing natural gas. H. S. Kenney will be in immediate charge of that section. Another section will be devoted to production. It will be under the direction of C. F. Cook, who will be in charge of the construction and operation of helium plants at Fort Worth. A general section, under the direction of Dr. Andrew Stewart, will deal with administrative work. The engineers detailed to do special work for the Board of Helium Engineers, the draftsmen, the mechanics and the clerks, will be under the immediate direction of that section. A fourth section will handle research. It is under the direction of C. W. Kanolt. An addition section will deal with the design and construction of repurification plants. It is under the direction of C. W. Seibel.

As has been announced, R. A. Cattell is the engineer in charge of the helium division. Dr. Stewart is his executive assistant and will be in charge of the division's administrative work.

International Union Will Meet in U. S. in 1926

The International Union of Pure and Applied Chemistry has accepted the invitation of the National Research Council to hold its 1926 meeting in this country. It is hoped that the meeting can be arranged so as to take place jointly with that of the American Chemical Society, which is to be held in Philadelphia in September, in connection with the Sesquicentennial. Since many members of the International Union are connected with institutions of learning, it is feared that a September meeting cannot be arranged. At any rate, a portion of the sessions will be held in Washington, and every facility will be extended to visitors to familiarize themselves with the work being done by the federal government.

Census Figures Show Gain in Plant Operations in 1923

The 1923 Census of Manufactures shows that 736 chemical plants, outside the major activities operated at 71.7 per cent of capacity. These plants in 1921 operated at 49.1 per cent of their capacity. Similar figures showing the output of certain other chemical or related products follow:

	Number of Plants	Per Cent of Capacity 1923	1921
Dye stuffs and tanning materials.....	125	61.4	48.2
Carbon black and bone black.....	68	84.2	82.0
Clay products.....	1,983	77.6	53.8
Crucibles.....	13	50.1	12.7
Fertilizers.....	573	55.6	50.4
Paints.....	602	71.2	61.2
Paper and wood pulp.....	746	81.3	62.5
Patent medicines.....	1,363	64.5	54.5
Cosmetics.....	465	71.3	60.3
Varnishes.....	224	70.2	60.5

Carrier Rates on Multiple Unit Tank Cars Protested

The Mathieson Alkali Works is protesting vigorously against the action of the carriers in making a tariff provision which would impose higher charges on multiple unit tank cars than on those cars having tanks that cannot be detached for filling, emptying or storing of the contents. The Interstate Commerce Commission has been asked to suspend the provision.

The multiple unit tank car, the Mathieson company contends, is the best and safest type of equipment yet devised for the transportation of liquefied chlorine gas.

"The commission should not and will not permit the scrapping of these tank cars, representing an investment approaching half a million dollars, merely to satisfy the arbitrary view of a classification committee," the company says in its representations to the commission.

It also points out that liquefied chlorine, within a few years has become an essential to the public health and to many industries and moves in volume to every rate territory in the country. Production has grown from 1,200 tons in 1914 to an annual rate of 110,000 tons at present. The demand for the product is increasing very rapidly, due to the success with which it is being used in pulp manufacture, for the purification of water supplies, the treatment of flour and grain, for bleaching purposes, the sterilization of sewage and the refining of gasoline.

Price War in Caustic Potash in Swedish Markets

Negotiations between Swedish and German manufacturers of caustic potash and potash lye have been discontinued. The owners of the Swedish factory at Hudiksvall, which has a capacity sufficient to supply 80 per cent of the Swedish demand, asked that 80 per cent of the Swedish demand be allocated to that factory. The Germans would not agree to this and the price war is continuing. As a result consumers of these commodities in Sweden are being supplied at a price much

below the price prevalent in other markets.

The German producers contend that since they have supplied the greater portion of the Swedish demand for 30 years that the Hudiksvall plant should accept a much lower percentage, and that the Swedes have inaugurated a price war from which only the Swedish soft soap industry benefits. The Swedes on the other hand contend that a 30 years' dominance of the Swedish market has created no vested interest for the German manufacturers. The Swedes are obtaining chloride of potash from France which has given them a certain independence from German manufacturers.

Larger Output of Aluminum Salts in 1924

According to information compiled by the Geological Survey, the production of aluminum salts in 1924 was 302,190 short tons, valued at \$9,301,410, as compared with 289,904 tons, valued at \$8,987,421 in 1923. The aluminum salts industry consumed 106,160 long tons of bauxite in 1924, as compared with 106,900 tons in 1923 and also consumed undetermined large quantities of high alumina clay.

ALUMINUM SALTS PRODUCED IN THE UNITED STATES IN 1924

Salt	Number of producers	Short Tons	Value
Alum:			
Ammonia.....	5	4,920	\$333,770
Sodium.....	4	13,920	765,740
Alumina hydrate.....	3	5,480	408,160
Aluminum chloride.....	3	5,510	724,430
Aluminum sulphate:			
Commercial:			
General.....	19	250,630	6,274,850
Municipal.....	6	5,690	89,160
Iron-free.....	7	15,570	673,470
Other aluminum salts.....	3	470	31,830
		302,190	9,301,410

Annual Meeting of Peninsular Fertilizer Association

The Peninsular Fertilizer Association, composed of fertilizer manufacturers and distributors in Delaware and Maryland, held their annual meeting in Ocean City, Md., June 27. On the day previous the members went to the Snow Hill experiment station to inspect the very striking comparisons which have been shown there as between fertilized and unfertilized plots. E. P. Dennis of Crisfield, Md., was elected president for the ensuing year.

Oklahoma To Have Courses in Petroleum Engineering

Director H. C. George of the School of Petroleum Engineering of the University of Oklahoma announces that 4-year courses are now to be given in petroleum production engineering, oil field management and the engineering of petroleum refining. The latter course is in charge of Fred W. Padgett, professor of refinery engineering. In it equal stress is laid on chemistry, including organic and physical chemistry, physics, mechanical engineering and mechanics.

A course in petroleum engineering research is open to senior and graduate

Calendar

AMERICAN CHEMICAL SOCIETY. 70th meeting, Los Angeles, Aug. 3 to 8.

AMERICAN ELECTROCHEMICAL SOCIETY. Chattanooga, Tenn., Sept. 24, 25 and 26.

CONGRESS OF INDUSTRIAL CHEMISTRY (Fifth) Paris, France, Sept. 27.

GAS PRODUCTS ASSN., 11th Annual Convention, at The Grand, Mackinac Island, Mich., July 21, 22 and 23.

INSTITUTE OF AMERICAN MEAT PACKERS. Annual meeting, Chicago, Oct. 16 to 21.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES, New York, Sept. 28 to Oct. 3.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING (Fourth), Grand Central Palace, N. Y., Nov. 30 to Dec. 5.

NATIONAL SAFETY COUNCIL. Annual meeting, Cleveland, Ohio, Sept. 28 to Oct. 2.

students. In this a subject is chosen, a search of the literature is made, the necessary experimental work performed, and a carefully written report of the literature, experimental work, and conclusions, is submitted. The scope of this work includes problems of drilling and development, production methods and equipment, natural gas, casing-head gasoline plants, refining methods and equipment, studies in the mining of oil sands and shales.

Export and Import Trade in Chemicals for May

The Department of Commerce has just issued statistics showing details of foreign trade for May. Import and export trade in the more important chemicals will be found in the following tables, the figures for May, 1924, being given for comparative purposes:

EXPORTS OF CHEMICALS

	May, 1925	May, 1924
Benzol, lb.....	8,333,935	23,538,244
Aniline oil and salts, lb.....	13,115	76,666
Acid, acetic, lb.....	60,451	77,381
Acid, boric, lb.....	50,537	37,032
Acid, sulphuric, lb.....	669,293	1,884,807
Methanol, gal.....	39,342	60,651
Aluminum sulphate, lb.....	3,024,516	2,125,644
Acetate of lime, lb.....	1,815,020	3,248,745
Calcium carbide, lb.....	643,491	846,320
Bleaching powder, lb.....	3,309,843	1,751,228
Copper sulphate, lb.....	225,565	32,884
Formaldehyde, lb.....	189,684	114,351
Potassium bichromate, lb.....	34,869	91,167
Sodium bichromate, lb.....	459,042	.....
Sodium cyanide, lb.....	181,563	176,464
Borax, lb.....	2,738,504	3,996,169
Soda ash, lb.....	1,809,845	1,811,960
Sodium silicate, lb.....	3,529,816	3,057,561
Sal soda, lb.....	1,206,180	1,031,246
Caustic soda, lb.....	7,462,808	6,237,549
Sulphate of ammonia, ton.....	6,147	7,599

IMPORTS OF CHEMICALS

	May, 1925	May, 1924
Dead or creosote oil, gal.....	6,844,589	7,328,553
Naphthalene, lb.....	156,432	285,906
Pyridine, lb.....	51,813	53,128
Arsenic, lb.....	1,305,980	2,386,871
Acid, citric, lb.....	56,000	47,600
Acid, formic, lb.....	145,058	118,524
Acid, oxalic, lb.....	33,688	118,828
Acid, sulphuric, lb.....	2,146,600	1,005,000
Acid, tartaric, lb.....	167,799	198,742
Ammonia, chloride, lb.....	668,057	428,781
Ammonia, nitrate, lb.....	560,618	327,307
Barium compounds, lb.....	1,767,733	2,086,055
Calcium carbide, lb.....	1,256,800	815,440
Copper sulphate, lb.....	49,505	94,742
Bleaching powder, lb.....	143,494	12,000
Potassium cyanide, lb.....	306,093	1,087,146
Potassium carbonate, lb.....	213,291	617,501
Potassium hydroxide, lb.....	672,852	792,639
Potassium chlorate, lb.....	1,111,702	855,028
Sodium cyanide, lb.....	2,715,909	3,283,945
Sodium ferrocyanide, lb.....	219,927	189,411
Sodium nitrite, lb.....	441	623,640
Sodium nitrate, ton.....	135,169	73,541
Sulphate of ammonia, ton.....	2,143	76

Men You Should Know About

CHARLES J. BRAND, formerly chief of the Bureau of Markets in the Department of Agriculture at Washington, became executive secretary of the National Fertilizer Association on July 1,



© Harris & Ewing.

Chas. J. Brand

with headquarters in Washington. During the war Mr. Brand was chairman of the committee on cotton distribution in the War Industries Board.

ROLAND B. DAY announces the continuance under his direction of the petroleum and oil shale consulting practice of Dr. David T. Day, 715 19th Street, Northwest, Washington, D. C.

DR. and MRS. HERBERT FREUNDLICH, of the Kaiser Wilhelm Institute of Berlin, were the guests of honor at the third Colloid Symposium in Minneapolis, June 17-19. Prof. Freundlich presented a paper on electrokinetic potentials. He will remain at the University of Minnesota to teach a course in colloid chemistry during the summer session.

PROF. EDWARD CURTIS FRANKLIN of Leland Stanford Junior University received the honorary degree of Doctor of Science from Northwestern University on June 15, 1925.

F. W. SPERR, JR., formerly chief chemist of the Koppers Co. Laboratories, has been appointed director of research. He is succeeded by O. O. Malleis as chief chemist and H. J. Rose becomes assistant chief chemist.

SIDNEY D. KIRKPATRICK, for the past three months with the Ethyl Gasoline Corp., returned to the staff of *Chem. & Met.* on June 15, in the capacity of associate editor.

PAUL C. RICH, formerly superintendent of the California plant of the General Chemical Co., has recently been transferred to the New York office, 40 Rector Street, to take charge of one of the divisions in the company's purchasing department.

CHAPLIN TYLER, assistant editor of *Chem. & Met.*, was married June 12 to Miss Harriet Scott of Medford, Mass.

D. S. MCAFEE, manager of the sanitary engineering department of The Dorr Co., has been appointed general

sales manager and will in the future direct the sales work of all departments of the company in the United States, Canada and Mexico.

WM. J. MISKELLA, for many years branch manager at Chicago for the DeVilbiss Mfg. Co., of Toledo, Ohio, has resigned to specialize in consulting work in connection with the use of nitrocellulose lacquer and other finishing materials. Mr. Miskella, who is president of the Lamberson Japanning Co., will have his office and laboratory at his company's office, 1164 West 22nd Street, Chicago, Ill.

C. B. BELLIS, formerly assistant editor on *Chem. & Met.*, has opened an office at 161 Milk Street, Boston, Mass., as consulting metallurgist.

George M. VERITY, president of The American Rolling Mill Co., received the honorary degree of Doctor of Laws at the commencement of Miami University, Oxford, Ohio, June 15.

G. C. RIDDELL, Chief of the Minerals Division of the Bureau of Foreign and Domestic Commerce tendered his resignation to acting director O. P. Hopkins, which was effective July 1. He will shortly leave for the West to examine the plants and properties of an oil company with which he will be associated in an advisory capacity. After a month's reconnaissance of the California, Utah and Wyoming properties of the company, Mr. Riddell will locate in New York as consulting engineer for the Alaska Pacific Coal Co. which has under development an anthracite property in the Bering River field of Alaska.

ROGER A. BOZARTH has recently taken a position as assistant gas engineer with the Northern Indiana Gas & Electric Co. at South Bend, Indiana.

CLYDE E. WILLIAMS, superintendent of the U. S. Bureau of Mines Station at Seattle, Washington, has returned to Seattle from the Argentine.

Prof. ALFONS KLEMENC, well-known Austrian chemist, holding the chair of chemistry at the University of Vienna, has arrived in the United States for an extended visit. He will assist in editing the international critical tables of the National Research Council at Washington, dealing primarily with the German department in the accumulation and verification of data.

R. R. DANIELSON, enamel expert of the A. J. Lindemann & Hoverson Co., Milwaukee, Wis., recently delivered a series of three lectures before the students in the department of ceramic engineering, University of Illinois, covering the "Preparation and Properties of Metal Enamels," and the "Enamel Industry."

W. C. GEER of the B. F. Goodrich Co. sailed from New York June 20, accompanied by his family. He expects to be in Europe for a year or more, where he will engage in some investigational work, besides enjoying a vacation.

JOHN L. BRAY, professor of metallurgy at Purdue University is engaged

in a study of Indiana coals for the Engineering Experiment Station.

PROF. R. HARCOURT, of the Ontario Agricultural College, was elected president of the Canadian Institute of Chemistry at the annual meeting in Guelph, Ontario.

J. S. WILSON, chief engineer of the Dryden Paper Co., Ltd., Dryden, Ontario, has been appointed general manager.

ARTHUR G. GREEN, the noted English authority on dyes, addressed the South Jersey Section of the American Chemical Society on June 9. In the course of his remarks he made the following significant statement: "The degree of civilization of a country can be measured by the number of chemists employed in that country."

DRS. WALTER and ROY CROSS, co-inventors of the Cross cracking process, and owners of the Kansas City Testing Laboratory, have recently been elected directors in the Industrial Testing Laboratory of Los Angeles.

COLONEL IRA FRAVEL has been designated by the Secretary of War to act as an advisor to the Bureau of Mines on helium matters. The Secretary of the Navy has appointed E. D. Land to serve in a similar capacity for the Navy Department. These two officers also represent their departments on the Helium Board.

DR. C. F. COOK has been appointed chief of the section of helium operations for the Bureau of Mines. He will be in immediate charge of the production plant at Fort Worth and will report to the physicist in charge of the Cryogenic laboratory.

R. A. CATTELL has been appointed engineer in charge of helium work for the Bureau of Mines. He has been serving the Bureau as superintendent of the Petroleum Station at Bartlesville. For the past three years Mr.



© Harris & Ewing.

R. A. Cattell

Cattell has been in charge of the cooperative work of the Bureau with the Natural Gas Association on the transportation and handling of natural gas. Under the new helium legislation the Bureau of Mines is responsible for current and reserve helium supply.

GOSTA OKERLOF, of Sweden, who was assistant to Professor Svante Arrhenius, has been granted a special Har-

ARLINGTON BENSEL, who has long been identified with the non-ferrous alloy industry, severed his connection with the Driver-Harris Co. on July 1, to be associated with Victor Hybinette of Wilmington, Del., in the development of industrial applications of the Hybnickel alloys. Mr. BenseL will have his headquarters with the Hybnickel Alloy Products Co., 300 Madison Ave., New York City, specializing in the production of chemical engineering equipment requiring special acid, corrosion and heat-resisting materials of construction.

Market Conditions and Price Trends

Seasonal Slowing Up in Production and Consumption of Chemicals

Normal Third Quarter With Favorable Outlook for Fall Trading Is Indicated—Decline in Metal Salts Lowers Weighted Index Number

TRADING in chemicals throughout June was along quiet lines but contract deliveries of important commodities were going forward in good volume and the more quiet aspect of the market was described as seasonal with no indications of a period of depression such as existed during the Summer and Fall of last year.

It is customary for manufacturing industries to curtail operations at this time of year and naturally this results in smaller withdrawals of raw materials. Finished stocks in the hands of producers who are large consumers of chemicals are not so large as a year ago and this encourages belief in a more active buying period for chemicals later in the year. Recent surveys of the leather and tanning industry have brought out predictions that the current year will show an increase of 25 per cent in business over 1924. Shipments of woollens in the present quarter are expected to be 15 per cent larger than in the corresponding quarter of last year and material increases are predicted for felts and natural silks in the same period. The movement of paints and paint materials is keeping up with the high standards set last year. Importations of rubber, despite the high prices ruling, are expected to total 87,000 tons for the present quarter which would mean an increase of 25 per cent over the third quarter of 1924.

Employment Figures for May

Production and consumption of chemicals may be reduced to a more or less concrete basis by a comparative study of employment figures for the industries which offer a wide outlet for those materials. The latest employment figures available are those compiled by the Bureau of Labor and refer to May. The figures show the following:

INDEX OF EMPLOYMENT			
	May 1923	April 1924	May 1924
Dyeing and finishing textiles	100.6	103	91
Leather	87.9	90.2	86.1
Paper and pulp	95.1	96.3	95.9
Chemicals	90.7	93.4	92.9
Fertilizers	78.9	153	84.7
Glass	91.6	94.1	96
Automobile tires	115.9	110.3	94.8
Petroleum refining	91.1	90.6	93.8

The above index is based on 100 as the monthly average for 1923. It will be noted that a very sharp decline is reported in production of fertilizers but operations in that industry in the pre-

ceding months were especially heavy and the industry completed the most successful year since the war. Incidentally, reports from Chile state that while sales of nitrate of soda for shipment during the new nitrate year which began June 1, have fallen off, the totals for the first 3 weeks being 980,000 tons as compared with 1,440,000 tons for the corresponding period last year, sales to this country were 320,000 tons as against 355,000 tons a year ago. This would indicate another active year in the domestic fertilizer trade.

The index of employment also reveals wider activities in the textile and leather trades than was the case in May, 1924. As these industries are consumers of a wide variety of chemicals, the comparisons are significant. Similar conditions are found in the tire industry with glass, petroleum refining and paper showing up less favorably. Apparent production of chemicals in May also was less than a year ago but this is in line with reports that producers have been influenced by a desire to prevent accumulations of stocks.

Decline in Weighted Index

During the past month, lower sales prices were announced for lead sulphate, lead carbonate, and zinc oxide. Lithopone also was marked down in price. These revisions resulted from lower production costs as represented by the easier position of the lead and zinc markets. Under this influence and aided by the easier position of ethyl and methyl alcohols, the weighted index number for prices was brought below that for the preceding month. The weighted number now stands at

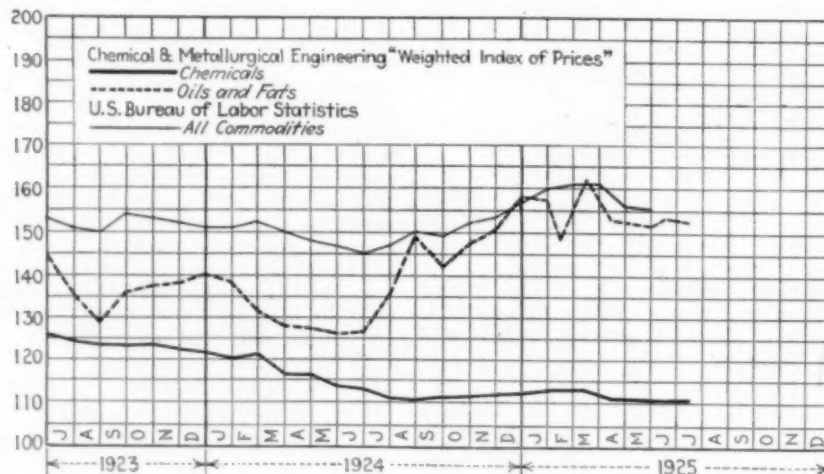
110.97 as compared with 111.76 in June and 110.61 in July, 1924. The majority of chemicals held a steady position with higher prices prevailing for sulphur, benzol, and tin salts.

Considerable variations were noted in the market for vegetable oils and fats but the weighted index number moved downward largely under the influence of linseed oil. The latter had been held at relatively high levels since the first of the year and with large supplies of flaxseed in the Argentine and in India, reports of a large acreage planted in the American Northwest, became a market factor and the decline in prices for linseed oil was caused by the large visible and prospective supply of seed rather than by any change in consuming demand for oil. Both crude and refined cottonseed oil have held up remarkably well in the face of the statistical position with speculative holdings of refined oil unusually large and heavy liquidation in the September option regarded as probable before the end of August. The weighted index number for oils and fats is 153.07 which compares with 153.87 a month ago and 136.25 a year ago.

Smaller Foreign Trade

Official returns place a valuation of \$4,949,251 for exports of chemicals in May as compared with \$5,078,623 for the preceding month, and \$5,115,688 for May, 1924. As compared with May, 1924, declines were pronounced in the case of coal-tar chemicals, sulphuric acid, and wood distillation chemicals. Exports of soda products however, increased by more than 2,500,000 lb., and substantial gains were recorded in outward shipments of chemical pigments, bleaching powder, and sulphate of aluminum.

Import trade in chemicals was larger in May than in the corresponding period of last year, though below the total for April. Values for imports were \$3,883,525 in May, \$3,979,826 in April, and \$3,651,654 in May, 1924.



Market Conditions and Price Trends

Facts and Figures of Business in Chemical Engineering Industries

PRODUCTION in manufacturing industries in May was slightly under that for the preceding month. The index number of the Department of Commerce was 128 for May, 129 for April, and 108 for May, 1924. Clay products was prominent in the group in which gains were recorded with foodstuffs reporting an advance of 7 per cent during the month. The output of chemicals and oils was larger

Industrial Statistics Presented Graphically for Those Who Follow the Monthly Trends of Production and Consumption

than in the 2 preceeding months with a very marked increase over the totals for the corresponding period last year. Decreases from the April totals occurred in the production of textiles, leather, iron and steel, lumber, and paper. Textiles and leather, however, showed gains as compared with the figures for May, 1924.

The output of raw materials was 2 per cent less than a year ago, the marketings of animal products decreasing 5 per cent and crop marketings 8 per cent, while mineral production increased 9 per cent. The index of unfilled orders showed a slight decrease during May but was 13 per cent higher than a year ago, both the iron and steel and building materials groups being higher on May 31 than they were a year ago.

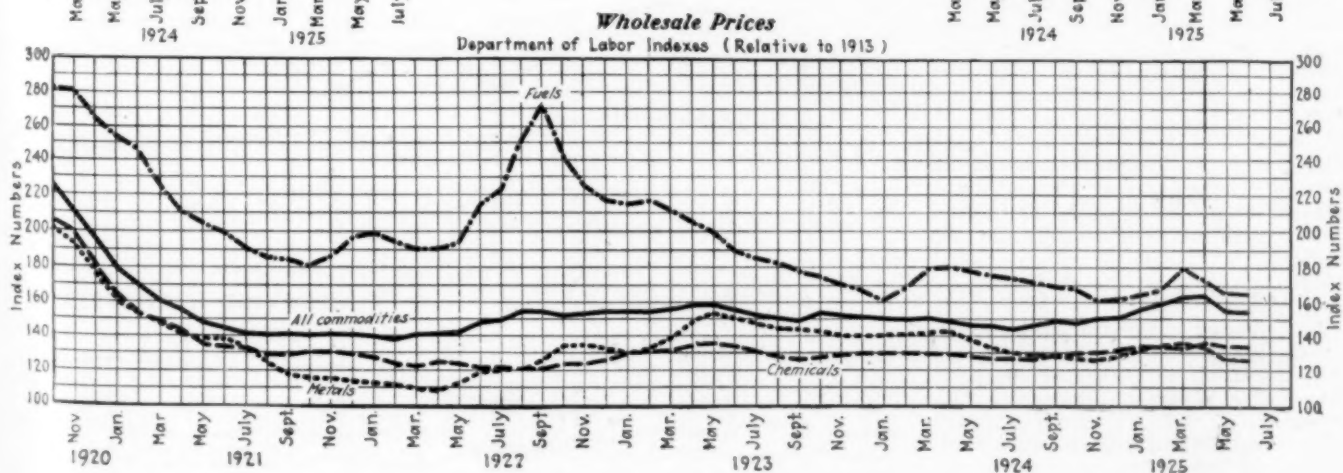
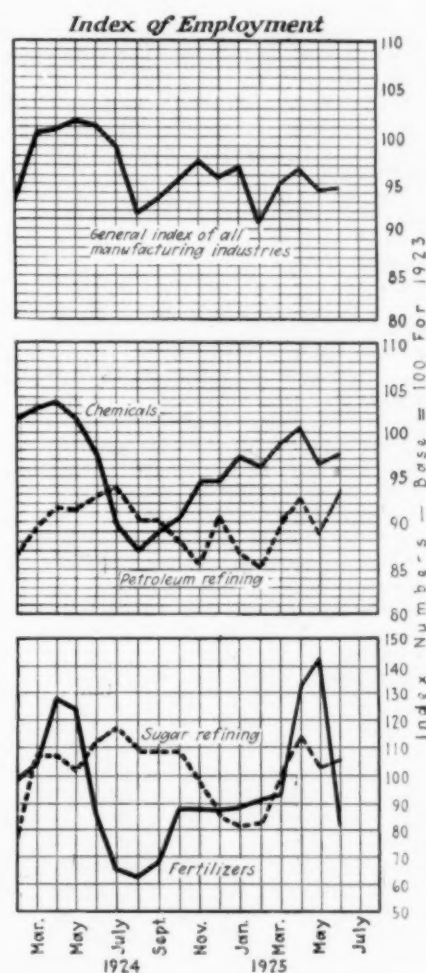
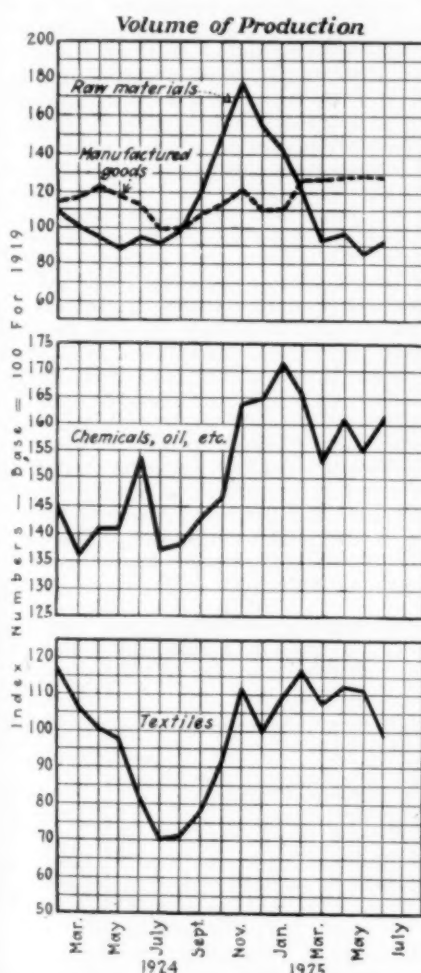
Stocks of commodities held at the end of May showed an increase of 3 per cent over April, when allowance is made for seasonal tendencies, and increased the same amount over a year ago. Stocks in the raw foodstuffs group increased considerably over April and over a year ago, those for manufactured foodstuffs and raw materials for manufacture decreased from both periods, while the manufactured commodities group showed no change from the end of April but increased slightly over a year ago.

Wholesale prices in May continued on a downward course according to compilations of the Bureau of Labor. The weighted index number declined to 155.2 as compared with 156.2 for April. This index number is based on 404

commodities or series of which 154 reported decreases in price for the month, 76 showed increases, and 154 remained at unchanged levels.

While the general price movement was downward, decreases in all groups were slight with only metals and metal products registering a decline in excess of 1 per cent. The rapid rise in prices for rubber had much to do with bringing about an advance in the price level for miscellaneous commodities.

The general price level increased about 5½ per cent over that of May last year. The greatest increase is found in miscellaneous commodities, farm products, and foodstuffs.



Market Conditions and Price Trends

Naval Stores Industry Maintaining Strong Position

Small Current Stocks, Greatly Decreased Production and Continued Demand of Foreign Countries Indicate Probable Advance in Rosin and Turpentine Prices

SINCE the period of severe deflation in 1920, there has been an almost uninterrupted advance in rosin prices. For example, water-white rosin advanced from an average of \$4.25 in 1921-22 to \$6.35 in 1924-25, and during the period of one year from July 1, 1924, to July 1, 1925, pale grades of rosin have doubled in price. The forward movement in the medium and lower grades has been scarcely less spectacular. The foregoing history of rosin prices is the result, solely, of the economic law of supply and demand, and not to manipulation on the part of speculative traders.

Factors making for continued strength in the present rosin market are (1) exceptionally small visible and invisible stocks on hand April 1, 1925; (2) a greatly reduced crop for the current season 1925-26; and (3) heavy buying in all foreign countries. Stocks of rosin at the 3 statistical American ports and at London were only 171,197 bbl. on March 31, 1925, as against 226,775 bbl. on the same date in 1924; 222,501 bbl. in 1923; 282,428 bbl. in 1922; and 301,972 bbl. in 1921. Furthermore, it is estimated that the rosin crop for the season 1925-26 will be about 150,000 bbl. short of what is considered normal production during the comparatively stable pre-war years. Crop shortage is due principally, to marked lack of rainfall in the gulf producing area, which comprises Texas, Mississippi, southern Louisiana and southern Alabama. Exports of rosin for the season 1924-25 were 1,463,468 bbl., or the largest movement to foreign countries since the pre-war season of 1913-14. Every European buying country contributed to this increase, and unusual activity was noted in South American countries, Japan, and in Australia. Heavy buying in Japan is attributed to the requirements of the paper industry. It is significant that heavy shipments to foreign ports continue, even in the face of recent sharp increase in prices; it is proof that rosin, though it be an alternative raw material in the chemical industries, is yet some distance from its marginal selling price. In sharp contrast to rosin, is the course of the spirits of turpentine market, which at present gives no indication of unusual developments.

Drouth Hurts Rosin Crop

The severity of the drouth during the past season is indicated by figures compiled by I. M. Cline, meteorologist of the U. S. Weather Bureau at New Orleans. For the 10 months ending with March, 1925, the deficiency of rainfall in southern Alabama was 2.39 in.;

for southern Mississippi 14.35 in.; for Louisiana 19.61 in.; and for Texas 11.42 in. During February, March, and April, 1925, there was a deficiency over the entire turpentine belt. The deficiency for Mississippi, Louisiana and Texas continued until well into May.

Reports from Texas show that lack of rain caused serious loss of timber, and that production of gum for the current season will be about 30 to 40 per cent below normal. Although Texas is relatively a small producing state in point of quantity, the fact that much water-white rosin is produced there has an important bearing on the market as a whole. Unless heavy rains come, it is likely that much permanent damage to round timber will result.

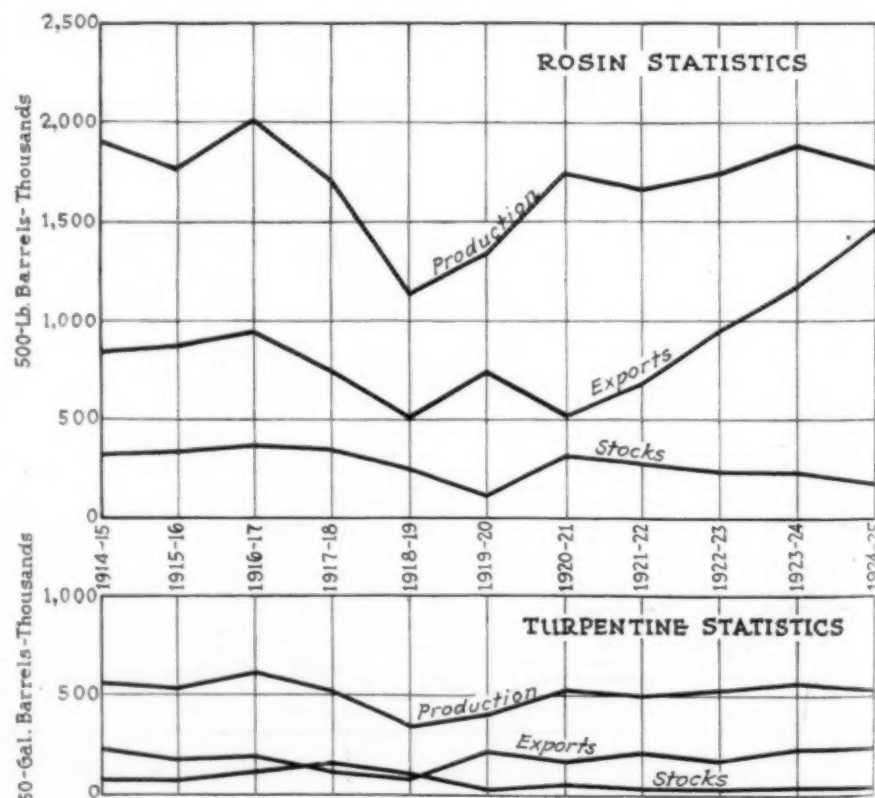
At the South Mississippi Experiment Station, extremely dry weather was experienced from July to November, 1924, and another shortage of rain began in February, 1925, making a total deficiency of 34 in. when the normal rainfall is 62 in. Much pine timber has died in this State, as in Texas. In Laurel, Miss., one of the largest owners reported losses from 15 to 16 per cent in his unworked timber. A few producers have reported good crops, but conditions as a whole have been decidedly unfavorable.

In Louisiana, several operators have been forced to close down because of the drouth, and others would follow suit if it were not for the disorganization of their field crews. Scattering of labor and timber shortage are two factors that have put Louisiana out of the running as a big factor in naval stores production.

Timber Culture Being Urged

Rainfall in the main producing states, Georgia and Florida, has been comparatively satisfactory. This region is the natural habitat of the commercial turpentine-producing pine, and the recent drouth has emphasized the importance of proper climatic conditions for the growth of this tree. In the opinion of J. C. Nash, president of the Columbia Naval Stores Company, Savannah, Ga., the industry ultimately will be confined to Georgia and Florida, with scientific reforestation playing a major rôle.

Systematic growing of turpentine-bearing trees has proved a success in France, and it is understood that the recently formed Pine Institute of America is actively behind a similar program for our domestic industry. With the resources visible and rapidly declining, the necessity of taking quick action is apparent. In this connection, O. H. L. Wernicke, general chairman of the Pine Institute of America, estimated recently that more than 50,000,000 acres of cut-over land in the South can be reforested, and that after 15 to 20 years, this reforested land would yield a net annual income of \$10 per acre. Barring damage by fire, and with proper utilization and culture, this income would be permanent.



Market Conditions and Price Trends

Decline in Sales Prices for Chemical Pigments Features Trading

White Lead, Zinc Oxide, and Lithopone Are Marked Down Under the Influence of Lower Costs for Raw Materials

AMONG the important developments in the market for chemicals during the month was a marking down of sales prices for the important chemical pigments, including basic carbonate and basic sulphate of lead, zinc oxide, and lithopone. These changes in price attracted attention because the former quotations had been in force for a long time. As these products have been moving into consumption freely, the lowering in values was not a reflection of trading conditions but was a logical sequence of reduced production costs.

The publication of figures showing importations of methanol in May served to accentuate the importance of the German synthetic product but the total did not seem so large when the explanation was forthcoming that delays had cut down April arrivals and the latter were entered with the May receipts. Total importations for the two months were less than the combined total for February and March.

Arsenic and calcium arsenate continued to hold a place of interest with the markets approaching a state of demoralization. Liquidation of both these products resulted in sales at prices far below the open market level. It is possible that further liquidation will follow and in the meantime values are uncertain.

The schedule of prices for nitrate of soda for shipment over the nitrate year which began on June 1, evidently has not influenced European buyers to place orders extensively as sales for European delivery are considerably below what they were at this time last year. On the other hand sales for shipment to the United States are pretty much in line with those of a year ago. This is regarded as a forerunner of large consumption in this country and an indication of another active year in the fertilizer industry.

Latest statistics on imports show that foreign-made dyes and colors are holding a steady position in our mar-

ket. Returns for June place arrivals from abroad at 376,668 lb. valued at \$333,654. This represents an increase in quantity over importations in May.

An interesting situation exists in the market for cottonseed oil. According to government figures, there was in the country on June 1, an equivalent of more than 1,000,000 bbl. of refined oil. A large cotton crop in the making promised an increased output of oil from that crop. Ordinarily such conditions would spell low prices for oil but the high prices maintained in the lard market have stimulated speculative buying of oil and a large part of surplus oil stocks are said to have been bought by speculators. These purchases have been switched, beginning in February, from one active trading month to another, and at present are largely centered in the September option. As the time draws near for tenders on that month, interesting developments may follow with a possibility of sharp fluctuations in price.

Preliminary Flaxseed Report

On July 9 the Bureau of Agriculture issued the first report on present season flaxseed crop of the American Northwest. The report placed total acreage at 3,466,000, condition as of July 1 at 81.6 per cent, indicated yield per acre at 7.5 bu., and probable output at 26,100,000 bu. Comparisons with the crops for preceding years are shown below, the preliminary report furnishing the figures for 1925 with the final reports used for the other years enumerated:

	Acreage	Bushels
1925	3,466,000	26,100,000
1924	3,289,000	30,173,000
1923	2,014,000	17,060,000
1922	1,113,000	10,375,000
1921	1,108,000	8,029,000

As domestic consumption of seed, not including planting requirements, now averages about 35,000,000 bu. for the crop year—from Sept. 1 to Aug. 31—it becomes apparent that outside sources of supply must be drawn upon in order to round out home needs for the 1925-26 crop year. This is a condition which has existed for many years and is of minor importance as a price factor in years when only moderate quantities of seed must be imported.

Present indications of a 26,100,000 bu. yield of seed if realized at the time of harvest, while falling short of the total for the preceding year, would not warrant belief in material rises in values for seed or for linseed oil. It is the figures of condition in which comparison with last year's crop causes uneasiness among buyers of linseed oil. The July report last year showed a con-

dition of 86.8 per cent and the 10-year average was 84.7 per cent.

Last year under a good start and with conditions favorable throughout the growing season, final returns showed larger yields than had been indicated in the early season reports. It is contrary to the law of averages for a crop which starts poorly to result in a final outturn larger than was foreshadowed in the early reports. It is logical, therefore, to expect greater deterioration in the present crop than was the case last year. In other words, it is probable that this country will produce less than 26,000,000 bu. of seed this season and the degree of difference between the estimate just issued and actual harvesting returns will be highly important in determining the price levels for linseed oil for the coming year.

The Dominion Bureau of Statistics on July 10 issued an estimate in which the Canadian flax crop for the coming season was placed at 10,480,000 bu. This compares with a final report of 8,626,000 bu. for the present year.

It is too early to obtain any reliable information on what will be done in the Argentine but reports of unusually large wheat sowings in that country lend credence to the opinion that a decrease will be found in the flax acreage. The world's supply of flaxseed, therefore, in the coming year promises to be somewhat below what it has been in the present year. This condition favors a slightly higher price average in all markets.

Although the data given in the current flaxseed report bears directly on the new crop year, it had an immediate effect on the present market and was followed by advances in price in the Duluth and Buenos Aires seed markets. Domestic crushers, likewise, announced an upward revision of 2c. per gal. in the sales price for linseed oil. Hence it is evident that the report was generally interpreted as of bullish significance.

Summarizing present conditions it would appear that the supply of seed for next year will be large enough to insure against drastic upward fluctuations in the oil market but the prospects favor an average price level higher than the prevailing quotation of 97c. per gal. unless unexpected changes occur in the seed situation.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	110.97
Last month	111.76
July, 1924	110.61
July, 1923	124.34

Lower prices for pigments, including white lead, zinc oxide, and lithopone contributed largely in lowering the weighted index number. Alcohol also figured in the downward trend of values. Liquidating sales almost demoralized the markets for arsenic and calcium arsenate. Sulphur and benzol moved upward in price.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	153.07
Last month	153.87
July, 1924	136.25
July, 1923	135.52

Weakness in Argentine flaxseed depressed linseed oil values and the latter show net declines of 11c. per gal. for the month. Coconut and soya bean oils also were lower. Crude cottonseed oil met with some demand at 10c. per lb. L.o.b. works.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. producing points, the quotations are given on that basis and are so designated. Prices for the corresponding period last month and last year are included for comparative purposes. Prices are corrected to July 11.

Industrial Chemicals

	Current Price	Last Month	Last Year
Acetone, drums.....lb.	\$0.12-\$0.13	\$0.12-\$0.13	\$0.15-\$0.16
Acid, acetic, 28%, bbl.....cwt.	3.00-3.25	3.00-3.25	3.12-3.37
Boric, bbl.....lb.	.08- .10	.08- .10	.09- .09
Citric, kegs.....lb.	.45- .47	.45- .47	.45- .47
Lactic, 44%, tech., light, bbl.....lb.	.13- .14	.13- .14	.12- .13
22% tech., light, bbl.....lb.	.06- .07	.06- .07	.06- .06
Muriatic, 18% tanks.....cwt.	.80- .85	.80- .85	.80- .85
Nitric, 36% carboys.....cwt.	.04- .04	.04- .04	.04- .04
Oxalic, crystals, bbl.....lb.	.10- .11	.10- .11	.10- .10
Sulphuric, 60% tanks.....ton	8.50-9.50	8.50-9.50	9.00-10.00
Tartaric, powd., bbl.....lb.	.27- .30	.28- .29	.27- .30
Alcohol, ethyl, 190 p.f. U.S.P. bbl.	4.85-4.90	4.90-	4.81-
Alcohol, denatured, 190 proof No. 1 special dr. gal.	.46- . . . .	.50- . . . .	.49-
No. 5, 188 proof, dr. gal.	.45- . . . .	.50- . . . .	.48-
Alum, ammonia, lump, bbl.....lb.	.03- .04	.03- .04	.03- .04
Potash, lump, bbl.....lb.	.02- .03	.02- .03	.02- .03
Aluminum sulphate, com., bags.....cwt.	1.40-1.45	1.40-1.45	1.35-1.40
Aqua ammonia, 26%, drums.....lb.	.06- .06	.06- .06	.06- .06
Ammonia, anhydrous, cyl.....lb.	.30- .32	.30- .32	.28- .30
Ammonium carbonate, powd., tech., casks.....lb.	.12- .12	.12- .12	.12- .13
Ammonium nitrate, tech., casks.....lb.	.08- .08	.08- .08	.09- .10
Ammonium sulphate, wks.....cwt.	2.50-2.55	2.55-2.60	2.60-2.65
Amylacetate tech., drums.....gal.	2.75-3.25	2.75-3.25	3.00-3.25
Arsenic, white, powd., bbl.....lb.	.04- .04	.04- .05	.07- .08
Arsenic, red, powd., kegs.....lb.	.12- .13	.12- .13	.15- .15
Barium carbonate, bbl.....ton	47.00-48.00	52.00-54.00	61.00-62.00
Barium chloride, bbl.....ton	58.00-60.00	61.00-63.00	79.00-82.00
Bleaching powder, f.o.b. wks., drums.....cwt.	1.90-2.00	1.90-2.00	1.90-
Borax, bbl.....lb.	.05- .05	.05- .05	.05- .05
Calcium acetate, bags.....cwt.	2.75-2.80	2.75-2.80	3.00-3.05
Calcium arsenate, dr.....lb.	.06- .07	.07- .08	.09- .10
Calcium carbide, drums.....lb.	.05- .06	.05- .06	.05- .05
Calcium chloride, fused, dr. wks.....ton	21.00-	21.00-	21.00-
Carbon bisulphide, drums.....lb.	.05- .06	.05- .06	.06- .06
Carbon tetrachloride, drums.....lb.	.07- .07	.07- .07	.07- .07
Chlorine, liquid, tanks, wks.....lb.	.04- .04	.04- .04	.04- .04
Copperas, bbl., f.o.b. wks.....ton	12.00-13.00	13.00-14.00	16.00-18.00
Copper carbonate, bbl.....lb.	.16- .17	.16- .17	.15- .16
Copper sulphate, bbl.....cwt.	4.50-4.60	4.50-4.60	4.50-4.85
Cream of tartar, bbl.....lb.	.21- .22	.21- .22	.20- .21
Epsom salt, dom., tech., bbl.....cwt.	1.65-2.00	1.75-2.00	1.75-2.00
Epsom salt, imp., tech., bags.....cwt.	1.30-1.40	1.30-1.40	1.15-1.20
Ethyl acetate, 85% drums.....gal.	.87- .90	.87- .90	.92- .95
Formaldehyde, 40%, bbl.....lb.	.08- .09	.09- .09	.09- .09
Fusel oil, crude, drums.....gal.	2.60-2.70	2.70-3.00	2.50-2.75
Glaucous salt, bags.....cwt.	.80-1.40	.80-1.40	1.00-1.40
Glycerine, c.p., drums, extra: lb.	.19- .19	.18- .19	.16- .17
Lead:			
White, basic carbonate, dry, casks.....lb.	.10- . . . .	.10- . . . .	.09-
White, basic sulphate, csk.....lb.	.09- . . . .	.10- . . . .	.09-
Lead acetate, white, bbl.....lb.	.14- .15	.14- .15	.14- .15
Lead arsenate, powd., bbl.....lb.	.16- .17	.16- .17	.16- .18
Lithopone, bags.....lb.	.05- .06	.06- .06	.06- .06
Magnesium carb., tech., bags.....lb.	.06- .07	.06- .07	.08- .08
Methanol, 95%, dr.....gal.	.58- .62	.65- .68	.74- .76
Methanol, 97%, dr.....gal.	.60- .64	.67- .69	.76- .78
Nickel salt, double, bbl.....lb.	.10- .10	.10- .10	.09- .10
Nickel salt, single, bbl.....lb.	.10- .11	.10- .11	.10- .11
Phosphorus, red, cases.....lb.	.75- .80	.90-1.00	.70- .75
Phosphorus, yellow, cases.....lb.	.34- .36	.34- .36	.35- .40
Potassium bichromate, casks.....lb.	.08- .08	.08- .08	.09- .09
Potassium carbonate, 80-85%, calcined, casks.....lb.	.05- .06	.05- .06	.05- .05
Potassium chlorate, powd., lb.	.08- .09	.08- .09	.07- .08
Potassium hydroxide (caustic potash) drums.....lb.	.07- .07	.07- .07	.06- .06
Potassium muriate, 80% bags ton	34.55-	34.55-	34.55-
Potassium nitrate, bbl.....lb.	.06- .06	.06- .07	.06- .07
Potassium permanganate, drums.....lb.	.14- .15	.14- .15	.14- .15
Potassium prussiate, yellow, casks.....lb.	.18- .19	.18- .19	.18- .18
Sal ammoniac, white, casks.....lb.	.05- .07	.05- .07	.06- .07
Sal soda, bbl.....cwt.	1.10-1.30	1.20-1.40	1.20-1.40
Soda ash, light, 58% bags, contract.....cwt.	1.25-	1.25-	1.25-
Soda, caustic, 76% solid, drums, contract.....cwt.	3.10-	3.10-	3.10-
Sodium acetate, works, bbl.....lb.	.05- .05	.05- .06	.04- .05
Sodium bichromate, casks.....lb.	.06- .06	.06- .06	.07- .07
Sodium chlorate, kegs.....lb.	.06- .06	.06- .06	.06- .07
Sodium chloride, tech.....ton	12.00-14.75	12.00-14.75	12.00-14.00
Sodium cyanide, cases, dom.....lb.	.18- .22	.18- .22	.19- .22
Sodium fluoride, bbl.....lb.	.08- .09	.09- .09	.08- .10
Sodium nitrate, bags.....cwt.	2.45-	2.55-2.60	2.60-
Sodium nitrite, casks.....lb.	.08- .09	.08- .09	.08- .08
Sodium phosphate, dibasic, bbl.....lb.	.03- .03	.03- .03	.03- .03

	Current Price	Last Month	Last Year
Sodium prussiate, yel. drums.....lb.	\$0.10-\$0.11	\$0.09-\$0.10	\$0.09-0.10
Sodium silicate (30%, drums).....cwt.	.75-1.15	.75-1.15	.75-1.15
Sodium sulphide, fused, 60-62% drums.....lb.	.03- .03	.02- .03	.03- .03
Sodium sulphate, crys., bbl.....lb.	.02- .03	.03- .03	.02- .03
Sulphur, crude at mine, bulk ton	15.00-16.00	14.00-16.00	14.00-16.00
Sulphur, flour, bag.....cwt.	2.35-3.00	2.35-3.00	2.25-2.35
Tin bichloride, bbl.....lb.	.16- . . . .	.15- . . . .	.12-
Tin oxide, bbl.....lb.	.60- . . . .	.58- . . . .	.48-
Tin crystals, bbl.....lb.	.39- . . . .	.38- . . . .	.33-
Zinc chloride, gran., bbl.....lb.	.07- .08	.07- .08	.05- .05
Zinc oxide, lead free, bag.....lb.	.07- . . . .	.07- . . . .	.07-
5% lead sulphate, bags.....lb.	.07- . . . .	.07- . . . .	.07-
Zinc sulphate, bbl.....cwt.	3.00-3.50	3.00-3.50	3.00-3.25

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.....lb.	\$0.15-\$0.16	\$0.16-\$0.16	\$0.15-
Chinawood oil, bbl.....lb.	.13- .13	.12- .13	.14- .14
Cocunut oil, Ceylon, tanks, N. Y.....lb.	.09- . . . .	.09- . . . .	.08- .08
Corn oil, crude, tanks, (f.o.b. mill).....lb.	.09- . . . .	.09- . . . .	.09-
Cottonseed oil, crude (f.o.b. mill) tanks.....lb.	.13- . . . .	.09- . . . .	.09- .09
Linseed oil, raw, car lots, bbl gal.	.97-	1.06- . . . .	.96-
Palm, Lagos, casks.....lb.	.09- . . . .	.09- . . . .	.07- .07
Niger, casks.....lb.	.05- . . . .	.08- . . . .	.07-
Peanut oil, crude, tanks (mill) lb.	.09- . . . .	.10- . . . .	.11-
Rapeseed oil, refined, bbl.....gal.	.98- .99	.98- .99	.78- .80
Sesame, bbl.....lb.	.15- .15	.15- .15	.11- .12
Soya bean tank (f.o.b. Coast) lb.	.11- . . . .	.11- . . . .	.10- .10
Sulphur (olive foots), bbl.....lb.	.08- .08	.08- .09	.09- .10
Cod, Newfoundland, bbl.....gal.	.63- .64	.63- .64	.60- .62
Menhaden, light pressed, bbl gal.	.75- .78	.72- .75	.56-
Crude, tanks (f.o.b. factory) gal.	.50- . . . .	.55- . . . .	.37-
Grease, yellow, loose.....lb.	.08- .09	.08- .09	.06- .07
Oleo stearine.....lb.	.13- .13	.12- .12	.12- .13
Red oil, distilled, d.p. bbl.....lb.	.11- .11	.11- .11	.09- .09
Tallow, extra, loose.....lb.	.07- .09	.08- .09	.07-

Coal-Tar Products

	Current Price	Last Month	Last Year
Aniline oil, drums, extra.....lb.	\$0.17-\$0.17	\$0.16-\$0.16	\$0.16-\$0.16
Aniline salts, bbl.....lb.	.20- .22	.20- .22	.22- .23
Anthracene, 80%, drums.....lb.	.60- .65	.63- .65	.75- .80
Benzol, 90%, tanks, works.....gal.	.25- .26	.23- .24	.25- .26
Beta-naphthol, tech., drums.....lb.	.22- .24	.22- .24	.24- .25
Creosylic acid, 97%, drums, works.....gal.	.59- .63	.59- .62	.63- .65
Naphthalene, flake, bbl.....lb.	.05- .05	.05- .05	.05- .05
Phenol, U.S.P. drums.....lb.	.23- .25	.23- .25	.26- .29
Picric acid, bbl.....lb.	.25- .26	.25- .26	.20- .22
Resorcinol, tech., kegs.....lb.	1.35-1.40	1.30-1.40	1.30-1.40
Salicylic acid, tech., bbl.....lb.	.33- .34	.33- .34	.31- .32
Solvent naphtha, w.w., tanks gal.	.25- . . . .	.25- . . . .	.25-
Toluene, tanks, works.....gal.	.26- . . . .	.26- . . . .	.30-
Xylene, com., tanks.....gal.	.26- .27	.25- .26	.28-

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl.....ton	\$17.00-\$17.50	\$17.00-\$17.50	\$16.00-\$17.0
Casein, tech., bbl.....lb.	.12- .13	.12- .13	.11- .12
China clay, powd., f.o.b. Ga. ton	10.00-20.00	12.00-15.00	14.00-20.00
Imported, powd.....ton	45.00-50.00	45.00-50.00	45.00-50.00
Dry colors:			
Carbon gas, black (f.o.b. works).....lb.	.07- .07	.07- .07	.09- .11
Lamp black, bbl.....lb.	.12- .40	.12- .40	.12- .40
Prussian blue, bbl.....lb.	.34- .36	.35- .37	.38- .42
Ultramarine blue, bbl.....lb.	.08- .35	.08- .35	.08- .35
Sienna, Italian, bbl.....lb.	.04- .12	.04- .12	.06- .14
Umber, Turkey, bbl.....lb.	.04- .04	.04- .04	.04- .04
Chrome green, bbl.....lb.	.28- .30	.27- .30	.28- .30
Carmine red, tins.....lb.	4.50-4.75	4.50-4.75	4.50-4.70
Para toner.....lb.	.90- .95	.90- .95	1.00-1.10
Vermilion, English, bbl.....lb.	1.40-1.50	1.40-1.45	1.40-1.45
Chrome yellow, C. P., bbl.....lb.	.17- .18	.18- .18	.17- .17
Coher, French, casks.....lb.	.02- .03	.02- .03	.02- .03
Feldspar, No. 1 (f.o.b. N. C.) ton	5.50-6.50	5.50-6.50	6.50-7.00
Graphite, Ceylon, lump, bbl.....lb.	.08- .08	.08- .09	.05- .06
Gum copal, Congo, bags.....lb.	.08- .10	.08- .10	.09- .14
East Indian, bags.....lb.	.14- .15	.14- .15	.16- .18
Manila, bags.....lb.	.14- .16	.14- .16	.18- .19
Damar, Batavia, cases.....lb.	.25- .26	.25- .26	.23- .24
Kauri, No. 1 cases.....lb.	.57- .65	.60- .65	.60- .65
Kieselguhr (f.o.b. N. Y.) ton	50.00-55.00	50.00-55.00	50.00-55.00
Magnesite, calc.....ton	35.00-42.00	35.00-42.00	35.00-40.00
Pumice stone, lump, bbl.....lb.	.06- .08	.06- .08	.05- .05
Imported, casks.....lb.	.03- .40	.03- .40	.03- .35
Pyrites, Span., fines, cif. unit	.12- .13	.11- .12	.10- .10
Domestic, fines (f.o.b. Ga.) unit	.12- . . . .	.12- . . . .	.10- .11
Shellac, orange, fine, bags.....lb.	.55- .57	.59- .60	.55- .56
Bleached, bonedry, bags.....lb.	.61- .67	.63- .68	.63- .64
T. N., bags.....lb.	.53- .55	.56- .58	.53- .54
Sonpstone (f.o.b. Vt.), bags ton	7.00-7.50	7.00-7.50	7.50-8.00
Talc, 200 mesh (f.o.b. Vt.) ton	11.00-	10.50-	10.00-
200 mesh (f.o.b. Ga.) ton	7.50-10.00	7.50-10.00	8.00-12.00
325 mesh (f.o.b. N. Y.) ton	14.75-	14.75-	14.75-
Wax, Bayberry, bbl.....lb.	.20- .21	.21- .22	.21- .21
Beeswax, ref., light.....lb.	.45- .49	.45- .49	.42- .34
Candellila, bags.....lb.	.30- .31	.30- .31	.23- .23
Carnauba, No. 1, bags.....lb.	.37- .38	.35- .37	.39- .40
Paraffine, crude 105-110 m.p.....lb.	.06- .06	.06- .06	.06-

Current Industrial Developments

New Construction and Machinery Requirements

Outstanding Opportunities

Aluminum	Niagara Falls, Que.
Asbestos	Pittsburg, Calif.
Brass	Hammond, Ind.
Brass	Cleveland, O.
Candy	Philadelphia, Pa.
Cement	Lewiston, Idaho
Chemicals	Everett (Boston P. O.) Mass.
Clay Products	Upper Sandusky, O.
Cresote	Spartanburg, S. C.
Gas	Bradenton, Fla.
Glass	St. Paul, Minn.
Gypsum	Port Mann, B. C.
Krimite	Chattanooga, Tenn.
Lacquer	San Francisco, Calif.
Leather	Peabody, Mass.
Oil	Ponca City, Okla.
Paper	Halifax, N. S.
Rubber	Cambridge (Boston P. O.) Mass.
Rubber	Akron, O.
Salt	Newark, Calif.
Sugar	East Grand Forks, Minn.
Vinegar	Somerville (Boston P. O.) Mass.

New England

Conn., Danbury—The New England Lime Co., recently incorporated in Delaware, with \$400,000 capital, will take over plants here and in various other locations, and plans extensions and improvements. J. K. McLaughlin, Hollidaysburg, Pa., is president.

Conn., Middletown—Wesleyan University, J. H. McConaughty, Pres., plans the construction of two buildings including a 2 story, 35 x 125 ft. laboratory. Estimated cost \$300,000. McKim, Meade & White, 101 Park Ave., New York, are architects.

Conn., Seymour—New Haven Copper Co., 79 Main St., plans improvements to plant including installation of electric machinery to replace steam. Estimated cost \$50,000.

Mass., Cambridge (Boston P. O.)—Cambridge Rubber Co., 748 Main St., is receiving bids for the construction of a 4 story, 80 x 100 ft. factory at Main and Windsor Sts. Estimated cost \$125,000. J. R. Worcester & Co., 79 Milk St., Boston, are engineers. Former bids rejected.

Mass., Everett (Boston P. O.)—Merri-mac Chemical Co., 148 State St., Boston, is receiving bids for the construction of a 2 story, 75 x 140 ft. manufacturing building here. Estimated cost \$100,000. Private plans.

Mass., Malden (Boston P. O.)—Eastern Cast Stone Co., 9 Binney St., Cambridge, awarded contract for the construction of a 1 story, 60 x 225 ft. plant on Eastern Ave. to S. Spector, 24 York St., Dorchester. Estimated cost \$50,000.

Mass., Newton Upper Falls (Boston P. O.)—Stowe & Woodward Inc., 181 Oak St., will build a 1 story, 43 x 40 and 45 x 65 ft. plant for manufacture of rubber by day labor. Estimated cost \$6,000. Private plans.

Mass., North Dighton—Mt. Hope Finishing Co., is receiving bids for the construction of a 1 story, 100 x 210 ft. dye house. H. M. Burke, c/o owners, is architect.

Mass., Peabody—Elvico Leather Co., Spring St., plans the construction of a plant to replace fire loss. Estimated cost \$70,000. Architect not selected.

Mass., Somerville (Boston P. O.)—New England Vinegar Works Inc. awarded contract for the design and construction of a 3 story 51 x 118 ft. manufacturing building, etc. to Lockwood, Greene & Co., 24 Federal St., Boston, Engrs.

Mass., South Boston (Boston P. O.)—Air Reduction Sales Co., 342 Madison Ave., New York, will soon receive bids for the construction of a 1 story addition to acetylene, cutting and welding plant here. Francisco & Jacobus, 511 5th Ave., New York, are architects.

Mass., Roberts (Waltham P. O.)—The Charles River Paper Co. has purchased a plant and plans to manufacture fibre paper.

Middle Atlantic

Del., Wilmington—Pyrites Co. Ltd., Christiansburg Ave., awarded contract for the construction of a 1 story, 100 x 235 ft. manufacturing building to Turner Construction Co., 1713 Sansom St. Estimated cost \$100,000.

This page is of value not only as a machinery market but also as an index of the general activity and growth of the industries served by Chem. & Met. The reports are gathered by our regular correspondents who are instructed to verify every detail. Requirements for new machinery will be published here free of charge.

Md., Baltimore—Mayor and City Council awarded contract for the construction of superstructures of building for addition to Monbello filters including a chemical building, etc. at Hartford Road and 33rd St. to J. H. Miller, Eutaw and Franklin Sts. \$309,630.

N. J., West New York (Br. Weehawken)—Arcione Electro Plating Co., 223 18th St., awarded contract for the construction of a 2 story, 80 x 100 ft. plant, to R. Rinaldi, 427 27th St. Estimated cost, with equipment, \$50,000.

N. Y., Canton—St. Lawrence University, R. E. Sykes, awarded contract for the construction of 2 story, 45 x 100 ft. A. Barton Hepburn Memorial Chemical Laboratory, here, to Munn & Shea, Newkirk Bldg., Montreal, Canada.

Pa., Creighton—Pittsburgh Plate Glass Co., Frick Bldg., Pittsburgh, will receive bids until July 18th for the construction of a 4 story office building including a laboratory here. Estimated cost \$150,000. Private plans.

Pa., Philadelphia—University of Pennsylvania, 34th and Spruce Sts., plans the construction of a chemistry building on the campus, West Philadelphia. Estimated cost \$1,000,000. Stewardson & Page, 315 South 15th St., are architects.

Pa., Philadelphia—H. O. Wilbur Co., 235 North 3rd St., awarded contract for the construction of a 4 story, 27 x 55 ft. candy factory at 3rd and New Sts., to William Steele & Sons Co., 219 North Broad St.

Pa., Philadelphia—William Penn Charter School, A. Scattergood, 409 Chestnut St., awarded contract for the construction of a 2 story 135 x 529 ft. laboratory and swimming pool at School, Lane and Fox Sts. to H. H. Conway, 5800 Walnut St.

South

Ala., Montgomery—Bond Bros. Inc., J. R. Bond, Pres., Louisville, Ky., plans the construction of a cresote plant on 80-acre site here. Estimated cost \$500,000.

Ala., Selma—Water Works Commission, R. Coleman, Mgr., will receive bids until July 29th for Cont. 1, iron removal plant including aerators, mixing chambers, filters, chemical and control house superstructure, etc. Cont. 2, filter equipment for 5,500,000 g.p.d. rapid sand filters, dry feed machines and chemical apparatus, etc. Morris Knowles, 507 Westinghouse Bldg., Pittsburgh, Pa., is engineer.

Ala., Sheffield—John R. Scott & Associates, Merchants Laclede Bldg., St. Louis, Mo., have organized a company and plan the construction of a plant for the manufacture of asphalt from limestone asphalt rock here. The company is in the market for asphalt machinery.

Fla., Bradenton—City, R. K. Van Camp, Comr. of Pub. Works, will receive bids until July 27th for the construction of a carburetted water and oil gas plant and distribution system, consisting of two generating sets 200,000 or 400,000 cu.ft., etc. J. B. McCrary Engineering Corporation, Atlanta, Ga., is engineer.

Ga., McIntyre—Edgar Plastic Kaolin Co., Edgar, Fla., plans the construction of additions to plant here.

La., Glenmora—A. K. Purdy, E. M. Pringle, et al, newly organized, plan the construction of a dehydrating plant on recently purchased site, here. \$75,000.

La., New Orleans—Alabama Portland Cement Co., Age Herald Bldg., Birmingham, Ala., is reported to have acquired the property of the Phoenix Portland Cement Co., here and in Birmingham. The company plans the construction of 2 kilns here.

S. C., Greenwood—Gulf Refining Co., plans the construction of plant to replace fire loss. J. E. Bradshaw, Jacksonville, Fla., is engineer.

S. C., Spartanburg—Taylor-Colquitt Co., Easley, plans the construction of a cresotting plant on 77 acre site, here. The plant includes two steel retorts, with capacity to treat 1,500,000 cross ties annually in addition to bridge timber, piling and lumber.

Tenn., Chattanooga—Blue Ring Products Co., C. H. Crimm, Pres., 1014 James Bldg., manufacturers of products of Krimite, is in the market for grinders and mixers for 40-ton daily capacity plant.

Tenn., Chattanooga—Franklin Processing Co., plans the construction of a drying mill. Estimated cost \$125,000 to \$150,000. J. E. Sirrine & Co., are engineers.

W. Va., Charlestown—Elkland Fire Brick Co. plans the construction of a plant for the manufacture of fire brick and refractories, on 300 acre site here. Estimated cost \$75,000. W. W. Brice, 311 Bigley Ave., is president.

W. Va., Yawkey—The South Penn Oil Co., Union Trust Bldg., Charlestown, plans the construction of a new gas compressor plant near here. Estimated cost \$100,000.

Middle West

Ill., Chicago—C. H. Hollup Corporation, 327 South La Salle St., awarded contract for the construction of a factory to manufacture steel stock for electric arc welding at South Turner Ave. and West 48th Place to Kreitzer Construction Co., 503 South Jefferson St. Estimated cost \$40,000.

Ill., Chicago—Marblehead Lime Co., B. L. McNulty, pres., 160 North LaSalle St., plans the construction of a factory near 103rd St. Architect not selected.

Ill., Chicago—Viscosity Oil Co., 1101 West 37th St., manufacturers of soap greases, awarded contract for rebuilding present plant and constructing 2 story addition to replace fire loss to G. L. Arquette & Co., 160 North LaSalle St.

Ind., Alexandria—Banner Rock Products Co. will soon receive bids for the construction of a 1 or 2 story, 160 x 200 ft. plant for the manufacture of mineral wool products to replace fire loss. Estimated cost \$40,000.

Ind., Hammond—The Hammond Brass Works awarded contract for the design and construction of a 90 x 320 ft. brass foundry, on Summer St., to The Austin Co., 6112 Euclid Ave., Cleveland, O. J. I. Lammering is vice president.

O., Akron—The Firestone Tire & Rubber Co. plans the construction of a 3 story, 200 x 400 ft. addition to plant, here. The Osborn Engineering Co., 7016 Euclid Ave., Cleveland, is architect.

O., Akron—General Tire & Rubber Co., 1708 East Market St., awarded contract for the construction of a 3 story, 40 x 220 ft. addition to heater room to Moran Construction Co., 413 Terminal Bldg., Cleveland. Estimated cost \$150,000.

O., Cleveland—Ferro Enameling Co., C. M. Horn, Secy., 4150 East 56th St., awarded contract for the construction of a 2 story, 23 x 54 ft. enameling room addition to Philip Kirschner & Co., 2914 East 75th St. Estimated cost \$40,000.

O., Cleveland—Industrial Fibre Co., 9801 Walford Ave., C. A. Nau, Construction Mgr., awarded contract for the construction of a group of buildings, 100 x 200, 50 x 80, 20 x 60, 25 x 40, 41 x 200 and 100 x 100 ft. extensions to factory on West 98th St. to M. B. Parker Construction Co., 1836 Euclid Ave. Estimated cost \$300,000.

O., Cleveland—Sterling Brass Co., S. Weil, Pres., 9600 St. Catharine Ave., is receiving bids for the construction of a 2 story, 40 x 125 ft. factory and warehouse. Estimated cost \$50,000. A. Sogg, 3030 Euclid Ave., is architect.

O., Marysville—The Federal Brass and Manufacturing Co., formerly the Federal Manufacturing Co., of Columbus, has acquired a plant here, and plan extensions and improvements. B. Van Etten is secretary.

O., Salem—Salem Rubber Co. will soon receive bids for the construction of addition to plant for the manufacture of rubber tubes at 1925 Elm St. Estimated cost \$40,000.

O., Upper Sandusky—Wyandot Clay Products Co. is having plans prepared for the construction of two buildings 40 x 224 and 115 x 147 ft. to replace fire loss. S. H. Leister, 203 North Sandusky St., is engineer.

Wis., Clintonville—Clintonville Milk Co., c/o J. Winkler and G. E. Schulz, will build a 2 story, 40 x 100 and 42 x 56 ft. manufacturing building by day labor. Estimated cost \$70,000. Private plans. Special machinery and equipment for the manufacture of powdered milk will be installed.

Wis., Merrill—Page Milk Co., L. Gilkey, Secy., awarded contract for the construction of a 2 story, condensed milk plant, to C. G. Torkelson, Merrill. Estimated cost \$150,000.

Wis., Waukesha—Waukesha Jelly Powder Co., Broadway and East Ave., awarded contract for the construction of a 2 story 52 x 77 ft. manufacturing building to Eckerman & Ruddell, 279 Layton Blvd., Milwaukee. Estimated cost \$40,000.

West of Mississippi

Colo., Boulder—University of Colorado is having plans prepared for the construction of a 3 story, 66 x 105 ft. chemistry building. Day & Klauder, Franklin Bank Bldg., Philadelphia, Pa., are architects.

Colo., Julesburg—Great Western Sugar Co., Sugar Bldg., Denver, plans the construction of a beet sugar mill near here.

Ia., Mediapolis—State Board of Education, W. H. Emmill, Secy., Des Moines, is receiving bids for the construction of a 4 story addition to chemistry building for State University here. Estimated cost \$175,000.

Minn., East Grand Forks—American Beet Sugar Co., 32 Nassau St., New York, awarded contract for the construction of a machine shop at its new mill now under construction, here, to J. A. Dinnie & Co., Grand Forks.

Minn., Minneapolis—City is in the market for alum handling equipment for new filter plant at Fridley. N. W. Elsberg is engineer.

Minn., St. Paul—Ford Motor Co., Highland Park (Detroit P. O.), Mich., awarded contract for the construction of a gas reduction plant, near Federal Dam in Mississippi River, also for glass plant unit at Mississippi River Blvd. and Edsel Ave., to G. H. Struchen, 405 Dakota Bldg., St. Paul. Estimated cost reduction plant \$250,000.

Mo., St. Louis—Fleischman Co., 4145 Forest Park Blvd., awarded contract for the construction of a 1 story, 30 x 175 ft. yeast plant on Forest Park Blvd. to Kremer & Voirel, Century Bldg. Estimated cost \$25,000.

Mo., Valley Park—Joseph Greenspon's Sons Iron & Steel Co., 3130 Hall St., St. Louis, has purchased plant of the Universal Glass Co. here and plans to reopen it as a glass manufacturing plant. L. Greenspon is president.

Okla., Ponca City—The Marland Oil Co., E. W. Marland, Pres., plans addition to refinery, to double capacity of the plant.

Tex., Brownwood—Olympia Oil & Refinery Co. plans the construction of extensions to the gasoline refinery recently acquired and the installation of additional equipment.

Far West

Aria, Yuma—Apache Oil & Refining Co., plans the construction of a topping plant for the manufacture of gasoline, kerosene and distillate. Estimated cost \$50,000. Company engineers in charge.

California—State plans the construction of a laboratory for State Teachers College at San Francisco. Estimated cost \$160,000. B. G. McDougall, Forum Bldg., Sacramento, is state architect.

Calif., Hynes—The United Oil Co., United Oil Bldg., Los Angeles, plans the construction of additions to plant here, to increase output from 10,000 to 25,000 bbls. per day. Company also plans a marine terminal, on 40 acre site, in Los Angeles. Estimated cost both projects \$700,000.

Calif., Newark—Morton Salt Co., 625 3rd St., San Francisco, plans the construction of a plant for manufacture of salt by

vacuum process, here. Estimated cost \$40,000.

Calif., Pittsburgh—H. W. Johns-Manville Co., 500 Post St., San Francisco, plans the construction of a plant for the manufacture of asbestos, etc. Estimated cost \$1,000,000.

Calif., San Francisco—Egyptian Lacquer Co., 50 Main St., awarded contract for the construction of a 1 story factory at Howard and Russ Sts., to G. P. W. Jensen, 320 Market St. Estimated cost \$40,000.

Idaho, Lewiston—Lewiston Portland Cement Co., Lewiston, plans the construction of a cement plant, here. Estimated cost \$1,500,000. T. J. Klossoki is company engineer.

Wash., Everett—The Everett Pulp & Paper Co., A. H. B. Jordan, V. Pres., plans the construction of a new mill, here. Estimated cost, with machinery, \$400,000. G. F. Hardy, 309 Broadway, New York, is engineer.

Canada

B. C., Port Mann—British Columbia Gypsum Co., Ltd., plans the construction of a plant, here, on recently acquired site, near the Canadian National Railway Terminal.

B. C., Vancouver—Fraser Valley Milk Producers Assn., 405 8th Ave. W., will build a group of buildings including a 3 story, 60 x 122 ft. milk plant, at Yukon St. and 8th Ave. by day labor. Estimated cost \$150,000. P. P. Brown, 410 London Bldg., is engineer. A 60 ton ammonia compressor and other equipment will be required.

Man., Winnipeg—Davis Gelatine Co., G. F. Davis, Dir., Sydney, Australia, plans the construction of a manufacturing plant here. Estimated cost \$1,000,000.

N. S., Halifax—R. P. Bell, is in the market for complete machinery for newsprint mill at Liverpool.

Ont., Dundas—W. H. Whittle, Matilda St., is in the market for equipment for repair shop including oxy-acetylene welding outfit to replace fire loss.

Ont., Goderich—Goderich Salt Co., is in the market for equipment for coarse salt plant.

Ont., Guelph—Standard White Lime Co., Waterloo Ave., is in the market for hydrating and transmission equipment and kilns to replace fire loss. Estimated cost \$30,000.

Ont., Jordan—Jordan Winery plans to install additional equipment, presses, etc., to increase capacity of winery. Estimated cost \$35,000.

Ont., Niagara Falls—Aluminum Co. of America, plans the construction of a plant here.

Sask., Regina—The Canadian Clay Products Co., newly organized, has taken over the plant of the Estevan Brick Co., here, and plans extensions and improvements.

Incorporations

Missouri China Co., Kansas City, Mo., \$25,000. T. E. Grogan, H. F. Grogan, Kansas City, Mo.

The Aluminum Smelting & Alloys Co., Inc., Hamden, Conn., smelting and refining, \$50,000. L. Lapides, M. Lapides, S. Levenstein, 327 Whalley Ave., New Haven, Conn.

Delaware Consolidated Oil Co., Dover, Del., \$2,000,000. I. L. Dunn, F. E. Dunn, O. C. Dunn, Tulsa, Okla. (Corp. Service Co.)

West Coast Paint Glass Co., Wilmington, Del., \$100,000. (Corporation Trust Co. of America.)

Mineral Products Corporation, Philadelphia, Pa., \$5,300,000. (Corporation Guaranty & Trust Co.)

V. C. V. Products Co., Philadelphia, Pa., soaps, \$200,000. (Corporation Guaranty and Trust Co.)

American Smelting Corporation, Dover, Del., \$2,500,000. G. L. Williams, W. J. McDonald, H. McGillis, Detroit, Mich. (Delaware Charter Co.)

Shelby Clay Products Co., Wilmington, Del., manufacture, \$300,000. (Colonial Charter Co.)

Continental Development Corporation, Wilmington, Del., manufacture coal tar and petroleum products, \$100,000. (Corporation Trust Co. of America.)

Hazen Paper Co., Holyoke, Mass., \$50,000. J. N. Hazen, E. E. Hazen, M. W. Hazen.

Castanea Paper Co., New York, increase capital from \$6,000,000 to \$15,000,000.

Patent Optical Co., Inc., Dover, Del., manufacture optical goods, \$100,000.

The Independent Oakal Co., Dover, Del., manufacture of "Oakal" from waste products; \$3,100,000.

Fredonia Portland Cement, Dover, Del., cement, \$3,000,000. (United States Corp. Co.)

United States Ichthyol Corporation, Wilmington, Del., miners, \$500,000. (Colonial Charter Co.)

Cookes Solder Co., Dover, Del., mineral compositions, \$50,000. S. S. Cooke, A. Cooke, Cataessa, Pa., Dr. T. C. Harter, Bloomsburg, Pa. (Capital Trust Co. of Del.)

E. I. Dupont de Nemours Co., Wilmington, increase capital from \$260,000,000 to \$310,000,000. (3,000 shares, \$1 each.)

North East Concrete Products Co., Dover, Del., clay of every kind and description; \$1,500,000.

Southern Insecticide Works, Inc., Dover, Del., manufacture and sell insecticides; \$30,000.

New England Lime Co., Dover, Del., manufacture cement, paving and road material; \$5,000,000.

Commercial Natural Gas Co., Dover, Del., petroleum and other oils, \$6,300,000.

Capston Glass Co., Dover, Del., increase capital from \$2,500,000 to \$3,000,000.

Panden Oil Corporation, Dover, Del., petroleum, \$40,000,000, 400,000 shares, no par. R. J. Hamilton, W. O. Hubbard, E. W. Stitt, Jr., T. H. Engel, H. A. Irmier, New York, N. Y. (Corp. Trust Co. of America.)

Star Manganese Co., Inc., Dover, Del., minerals, \$200,000.

National Coal Distillation Co., Wilmington, Del., minerals, \$5,000,000 (Corp. Trust of America.)

Ravenwood Oil & Gas Co., Wilmington, Del., \$1,000,000. (American Guaranty & Trust Co.)

Limestone Rock Asphalt Co., Tampa, Fla., 1,000 shares no par value; limit of indebtedness \$500,000. R. W. Sanders, Pres., D. B. O'Connor, Secy.

Milton Cane Products, Inc., Milton, La., \$125,000. P. A. Duplex, Pres., Youngsville, La.

Lafourche Sugar Refining Co., Inc., New Orleans, La., \$5,000. E. M. Lobe, 618 Magazine St., New Orleans, La.

United States Paint Co., New Orleans, La., increase capital, \$2,000,000 to \$6,100,000.

Soatburn Cotton Oil Co., Louisiana, New Orleans, La., \$45,000,000.

Federal Products Co., Boston, Mass., soap, \$100,000. C. J. Brown, Winthrop; G. Dandreville, Concord; J. E. Macy, Newton.

Pittston Industrial Alcohol Co., Camden, N. J., 1,000 shares, no par; J. P. Murray, F. S. Muzzey, S. S. Sauerman, Philadelphia, Pa. (Attorney Corporation Trust Co., Philadelphia, Pa.)

The No-Tarnish Co., Irvington, N. J., \$250,000. B. L. Chapman, G. L. Burgess, Upper Montclair. (Attorney C. C. Gormany, New York, N. Y.)

B. B. Clark Optical Co., Rochester, 400 shares, \$100 each, 2,000 common, no par. B. B. Clark, C. S. Hawkins, R. D. Dow (Attorneys Castle & Fitch, Rochester.)

Buffalo Electro Chemical Co., Buffalo, 10,000 shares, \$100 each; 10,000 common, no par. C. A. Burk, A. W. Sawyer, H. J. Kelly (Attorneys Dudley, Stowe & Sawyer, Buffalo.)

New York and Pennsylvania Co., paper \$9,000,000. A. C. Pains, Jr., Willsboro, N. Y., R. Wetherill, Chester, Pa., G. Paine, E. Paine, Willsboro, N. Y., J. S. Parker, South Orange, N. J. (United States Corp. Co.)

Plainview Cotton Oil Co., Plainview, Tex., \$125,000. G. G. Fix, J. M. Hardaway, Plainview, Tex.

Bryan Fertilizer Co., Alexandria, Va., \$150,000. A. H. Bryant, Alexandria, Va.

Beyer Admanto Co., New York, N. Y., make paints, 1,000 common, no par; Beyer, F. C. Bangs, A. Scharnberg. (Attorneys Satterlee & Canfield, 49 Wall St., New York, N. Y.)

E. & J. Elder Co., New York, N. Y., gold leaf and bronze powder, \$25,000. J. and E. Elder, W. Frick. (Attorney H. Moerchen, 686 Lexington Ave., New York, N. Y.)

Triton Oil & Fertilizer Co., New York, N. Y., increase capital 500 to 8,500 shares, of which 2,500 are \$100 each and 5,000 common, no par.

Union Soap Corporation, Brooklyn, N. Y., \$25,000. I. Sherman, T. R. Hennenlotter, H. L. Rodner. (Attorney J. C. Zimmerman, 305 Broadway, New York, N. Y.)

Beverly Rubber Co., Boston, Mass., capital 1,000 shares of no par common stock. W. M. Floring, Brighton, L. S. Monaghan, East Braintree, G. P. Nicoll, Foxboro.